lenovo

ThinkServer TS440
Hardware Maintenance Manual

ThinkThinkThinkServerThink

Machine Types: 70AL, 70AM, 70AN, and 70AQ

Note: Before using the information and the product it supports, be sure to read and understand the following:

- The *Read Me First* that comes with your product
- “Safety information” on page iii
- Appendix A “Notices” on page 177

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Safety information

Note: Before using the product, be sure to read and understand the multilingual safety instructions on the documentation DVD that comes with the product.

قبل استخدام المنتج، تأكد من قراءة إرشادات الأمان متعددة اللغات وفهمها، وتوجد هذه الإرشادات في قرص DVD الوثائقي الذي يأتي مع المنتج.

Antes de usar o produto, leia e entenda as instruções de segurança multilíngues no DVD de documentação que o acompanha.

Преди да използвате този продукт, задължително прочетете и вникнете в многоезичните инструкции за безопасност в DVD диска с документация, който се предоставя с продукта.

Prije upotrebe ovog proizvoda obavezno pročitajte višejezične sigurnosne upute koje se nalaze na DVD-u s dokumentacijom koji dobivate uz proizvod.

Před použitím produktu je třeba si přečíst a porozumět bezpečnostním pokynům uvedeným na disku DVD s dokumentací, který je dodáván s produktem.

Før du bruger produktet, skal du sørge for at læse og forstå de sikkerhedsforskrifter, der findes på flere sprog, på den dokumentations-dvd, der følger med produktet.

Lue tuotteen mukana toimitetulla DVD-tietolevyllä olevat monikieliset turvaohjeet ennen tämän tuotteen käyttöä.

Avant d'utiliser le produit, veillez à bien lire et comprendre les instructions de sécurité multilingues figurant sur le DVD de documentation fourni avec le produit.

Πριν χρησιμοποιήσετε το προϊόν, βεβαιωθείτε ότι έχετε διαβάσει και κατανοήσει τις οδηγίες ασφάλειας, οι οποίες είναι διαθέσιμες σε διάφορες γλώσσες στο DVD τεκμηρίωσης που συνοδεύει το προϊόν.

Vor Verwendung des Produkts sollten Sie unbedingt die mehrsprachigen Sicherheitsanweisungen auf der Dokumentations-DVD lesen, die im Lieferumfang des Produkts enthalten ist.

לפני השימוש במוצר, הקפידו לקרוא ולהבין את הוראות הבטיחות, המופיעות בשפות שונות ב-DVD התיעוד המצורף למוצר.

A termék használata előtt mindenképpen olvassa el és értelmezze a termékhez kapott dokumentációs DVD lemezen található, több nyelven elolvasható biztonsági előírásokat.

Prima di utilizzare il prodotto, accertarsi di leggere e comprendere le informazioni sulla sicurezza multilingue disponibili sul DVD di documentazione fornito con il prodotto.

製品をご使用になる前に、製品に付属の Documentation DVD に収録されているマルチリンガルの「安全に正しくご使用いただくために」を読んで理解してください。

제품을 사용하기 전에 제품과 함께 제공되는 문서 DVD의 다국어 안전 지침을 주의 깊게 읽어보십시오.

Voordat u het product gebruikt, moet u ervoor zorgen dat u de meertalige veiligheidsinstructies op de documentatie-dvd van het product hebt gelezen en begrijpt.

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Przed skorzystaniem z produktu należy zapoznać się z wielojęzycznymi instrukcjami bezpieczeństwa znajdującymi się na płycie DVD z dokumentacją dostarczoną wraz z produktem.

Antes de utilizar o produto, leia atentamente as instruções de segurança multilingues que constam no DVD de documentação fornecido com o produto.

Înainte de a utiliza produsul, asigurați-vă că ați citit şi înțeles instrucțiunile de siguranță în mai multe limbi de pe DVD-ul cu documentație care însoțeşte produsul.

Før du bruker produktet, må du lese og forstå den flerspråklige sikkerhetsinformasjonen på DVDen med dokumentasjon som følger med produktet.

Прежде чем использовать этот продукт, внимательно ознакомьтесь с инструкциями по технике безопасности на разных языках, которые можно найти на DVD-диске с документацией в комплекте с продуктом.

在使用本产品之前，请务必先阅读和了解产品附带的文档 DVD 中的多语言安全说明。

Pre nego to upotrebite proizvod obavezno paljivo proitajte i prouite viejeziko uputstvo za bezbednost na dokumentacionom DVD-u koji ste dobili uz proizvod.

Pred pouvanm produktu si pretajte viacjazyn bezpenostn pokyny na disku DVD s dokumentciou dodanom s produktom.

Preden začnete uporabljati izdelek, je pomembno, da preberete in razumete večjezična varnostna navodila na DVD-ju z dokumentacijo, ki ste ga prejeli skupaj z izdelkom.

Antes de utilizar el producto, asegúrese de leer y comprender las instrucciones de seguridad multilingües del DVD de documentación que se proporciona con el producto.

Var noga med att läsa säkerhetsinstruktionerna på dokumentations-DVD-skivan som följer med produkten innan du börjar använda produkten.

使用本產品之前，請務必閱讀並瞭解產品隨附的文件 DVD 上的多國語言版本安全資訊。

Bu ürünü kullanmadan önce, ürünle birlikte gönderilen belge DVD'si üzerindeki çok dil içeren güvenlik yönergelerini okuyup anladýðýnýzdan emin olun.

Перед використанням цього продукту уважно ознайомтеся з інструкціями з техніки безпеки на різних мовах, що можна знайти на DVD-диску з документацією в комплекті з продуктом.

Important: For translated versions of the caution or danger statement, refer to the *Safety, Warranty, and Support Information* document.

Ensure that you read and understand all caution and danger statements in this document before you perform the procedures. Read and understand any additional safety information that is included with the server or optional device before you install, remove, or replace the device.

Statement 1

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Ensure that all power cord connectors are securely and completely plugged into receptacles.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To connect:	**To disconnect:**
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlets.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlets.	4. Remove all cables from devices.
5. Turn devices ON.	

Statement 2

DANGER

Danger of explosion if battery is incorrectly replaced.

When replacing the lithium coin cell battery, use only the same or an equivalent type that is recommended by the manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

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Statement 3

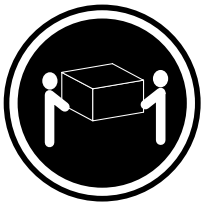
CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

DANGER

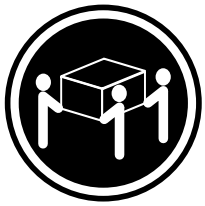
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following: **Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.**

Statement 4



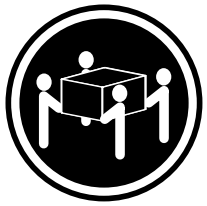
≥ 18 kg (39.7 lb)

< 32 kg (70.5 lb)



≥ 32 kg (70.5 lb)

< 55 kg (121.2 lb)



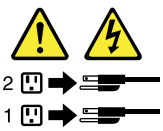
≥ 55 kg (121.2 lb)

< 100 kg (220.5 lb)

CAUTION:
Use safe practices when lifting.

Statement 5

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 6

CAUTION:
If you install a strain-relief bracket option over the end of the power cord that is connected to the device, you must connect the other end of the power cord to a power source that is easily accessible in case it needs to be disconnected.

Statement 7

CAUTION:
If the device has doors, ensure that you remove or secure the doors before moving or lifting the device to protect against personal injury. The doors will not support the weight of the device.

Statement 8

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Statement 9

CAUTION:
Disconnect the hot-swap fan cables before removing the fan from the device to protect against personal injury.

Statement 10

CAUTION:
The following label indicates a sharp-edge hazard.

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Statement 11

CAUTION:
The following label indicates a potential heat hazard.

Statement 12

DANGER

Overloading a branch circuit is a potential fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch current ratings at the installation site.

Statement 13

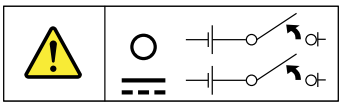
CAUTION:
Ensure that the rack is secured properly to avoid tipping when the server unit is extended on the rails.

Statement 14

CAUTION:
Some accessory or option board outputs exceed Class 2 or limited power source limits. You must install the appropriate interconnecting cabling in accordance with your local electrical code requirements.

Statement 15

CAUTION:
The power-control button on the device may put the device in standby mode instead of turning off the device. In addition, the device might have multiple connections to dc power. To remove all electrical current from the device, ensure that all connections to dc power are disconnected at the dc power input terminals.



Statement 16

CAUTION:
To reduce the risk of electric shock or energy hazards:

- **This equipment must be installed by trained service personnel in a restricted-access location, as defined by your local electrical code and the latest edition of IEC 60950.**
- **Connect the equipment to a reliably earthed safety extra low voltage (SELV) source. An SELV source is a secondary circuit that is designed so that normal and single fault conditions do not cause the voltages to exceed a safe level (60 V direct current).**
- **The branch circuit overcurrent protection must be rated in accordance with local electrical code requirements.**
- **Use 1.3 mm^2 or 16 American Wire Gauge (AWG) copper conductor only, not exceeding 3 meters in length.**
- **Torque the wiring-terminal screws to 1.4 newton-meters or 12 inch-pounds.**
- **Provide a readily available, approved and rated disconnect device in the field wiring.**

Statement 17

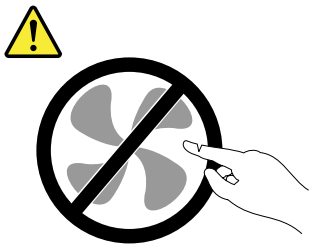
CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments.

Statement 18

CAUTION:
Do not place any object on top of rack-mounted products.

Statement 19

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



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Statement 20

CAUTION:
A lithium ion battery is provided. To avoid possible explosion, do not burn the battery. Replace the battery only with the Lenovo-approved part. Recycle or discard the battery as instructed by local regulations.

Products that are not assessed

Typical products that are **not assessed** include but not limited to the following:

- Server and IT-rack components (for example, uninterruptible power supplies and current distribution systems)
- Devices in IT rooms (for example, bulk storage units and network products)
- Industrial low-voltage switchgear

Chapter 1. General information

This chapter provides some general information about your product.

This chapter contains the following items:

- “Introduction” on page 1
- “Server documentation” on page 2

Introduction

This user guide for your Lenovo® ThinkServer® product contains information about the server features, specifications, component locations, configuration instructions, hardware replacement procedures, and basic troubleshooting and diagnostics.

Your server comes with a documentation DVD that contains various server documents to help you use and maintain the server. Meanwhile, your server comes with a *ThinkServer EasyStartup* DVD that provides a convenient solution for configuring the server and installing an operating system.

The Lenovo Limited Warranty (LLW) contains the warranty terms that apply to the product you purchased from Lenovo. Read the LLW on the documentation DVD that comes with your server. A printable generic version of the latest LLW also is available in more than 30 languages at http://www.lenovo.com/warranty/llw_02. If you cannot obtain the LLW through the documentation DVD or Lenovo Web site, contact your local Lenovo office or reseller to obtain a printed version of the LLW, free of charge.

For warranty service, consult the worldwide Lenovo Support telephone list. Telephone numbers are subject to change without notice. The most up-to-date telephone list for Lenovo Support is always available on the Web site at http://www.lenovo.com/support/phone. If the telephone number for your country or region is not listed, contact your Lenovo reseller or Lenovo marketing representative.

To obtain the most up-to-date information about the server, go to:
http://www.lenovo.com/thinkserver

Lenovo maintains pages on the World Wide Web where you can get the latest technical information and download documentation or device drivers and updates. To access the Lenovo Support Web site, go to:
http://www.lenovo.com/support

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Record information about your server in the following table. You will need the information if you ever need to have your server serviced.

For where to find the product information label on the chassis, see “Machine type, model, and serial number label” on page 12.

Product name	_____
Machine type and model (MT-M)	_____
Serial number (S/N)	_____
Date of purchase	_____

You can register your server with Lenovo by following the instructions at:
http://www.lenovo.com/register

When you register your server, information is entered into a database, which enables Lenovo to contact you in case of a recall or other severe problem. After you register your server with Lenovo, you will receive quicker service when you call Lenovo for help. In addition, some locations offer extended privileges and services to registered users.

Server documentation

This topic provides general descriptions of the various documentation for your server and instructions on how to obtain all the documentation.

Printed documents

The following document is printed out and contained in your server package.

Read Me First

This is a multilingual document you should read first. This document guides you to read the complete warranty, support, and safety information on the documentation DVD that comes with your server before using the product. This document also provides information about how to find the most up-to-date information on the Lenovo Support Web site. This document includes safety and legal notices that you should read and understand before using the server.

Documentation DVD

The documentation DVD, which comes with your server, contains various documents for your server in Portable Document Format (PDF). To view the documentation, you need to have the Adobe Reader program installed. You can download the desired language version of the latest Adobe Reader program from the Adobe Web site at:
http://www.adobe.com

To start the documentation DVD, insert the DVD into the optical drive. The DVD is AutoPlay enabled and starts automatically in most Microsoft® Windows® environments. If the DVD fails to start or if you are using a Linux® operating system, open the launch.htm file located in the root directory of the DVD.

Note: Lenovo maintains pages on the World Wide Web where you can get the latest technical information and download documentation or device drivers and updates. Some information in the documents on the documentation DVD might change without notice after the first release of the DVD. You can always obtain all the most up-to-date documentation for your server from the Lenovo Web site at:
http://www.lenovo.com/UserManuals

The following documents are on the documentation DVD that comes with your server:

- *Safety, Warranty, and Support Information*

  This is a multilingual document that includes all the safety statements for your product in more than 30 languages. Be sure to read and understand all the safety statements before using the product. This document includes the Lenovo warranty statement, Customer Replaceable Units (CRUs) information, and information about how to contact the Lenovo Customer Support Center.

- *Lenovo License Agreement*

  This document includes the terms and conditions of the Lenovo License Agreement.

- *User Guide*

  This document provides detailed information to help you get familiar with your server and help you use, configure, and maintain your server.

- *MegaRAID SAS Software User Guide*

  This document provides information about Redundant Array of Independent Disks (RAID) and how to use the utility programs to configure, monitor, and maintain your server RAID and related devices. This document is in English only.

  Note: Refer to this document for hardware RAID information if you have a required RAID card installed in the server. See “Installing or removing the RAID card” on page 82. For information about the ThinkServer RAID 100 (also known as the onboard SATA software RAID), see “Configuring the system BIOS to enable onboard SATA RAID functionality” on page 59.

Document for trained service personnel only

The following document is intended only for trained service personnel of Lenovo.

Hardware Maintenance Manual

This document provides information about component locations, replacement procedures for major Field Replaceable Units (FRUs), and troubleshooting and diagnostics. This document is updated frequently, and the most up-to-date version is always available in English on the Lenovo Web site at:
http://www.lenovo.com/UserManuals

Chapter 2. Server setup road map

This chapter provides a general road map to guide you through setting up your server.

The server setup procedure varies depending on the configuration of the server when it was delivered. In some cases, the server is fully configured and you need to connect the server to the network and an ac power source, and then you can turn on the server. In other cases, the server needs to have hardware features installed, requires hardware and firmware configuration, and requires an operating system to be installed.

The general procedure for setting up your server is:

1. Unpack the server package. See “Server package” on page 7.
2. Install any required hardware or server option. See the related topic in Chapter 6 “Installing, removing, or replacing hardware” on page 65.
3. Connect the Ethernet cable and power cords to the server. See “Rear view of the server” on page 17 to locate the connectors.
4. Turn on the server to verify operation. See “Turning on the server” on page 45.
5. Review the Unified Extensible Firmware Interface (UEFI) Basic Input Output System (BIOS) settings and customize as needed. See “Using the Setup Utility program” on page 47.
6. Configure RAID and install the operating system and basic drivers. See “Using the ThinkServer EasyStartup program” on page 54 and “Configuring RAID” on page 57.
7. Install any additional drivers needed for added features. Refer to the instructions that come with the hardware option.
8. Configure Ethernet settings in the operating system by referring to the operating system help. This step is not required if the operating system was installed using the ThinkServer EasyStartup program.
9. Check for firmware and driver updates. See “Updating the firmware” on page 62.
10. Install other applications. Refer to the documentation that comes with the applications that you want to install.

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Chapter 3. Product overview

This chapter provides information about the server package, features, specifications, software programs, and component locations.

This chapter contains the following items:

- “Server package” on page 7
- “Features” on page 7
- “Specifications” on page 11
- “Software” on page 11
- “Locations” on page 12

Server package

The server package includes the server, power cords, printed documentation, a documentation DVD, and software media.

Note: Depending on the model, your server might look slightly different from the illustration in this topic.

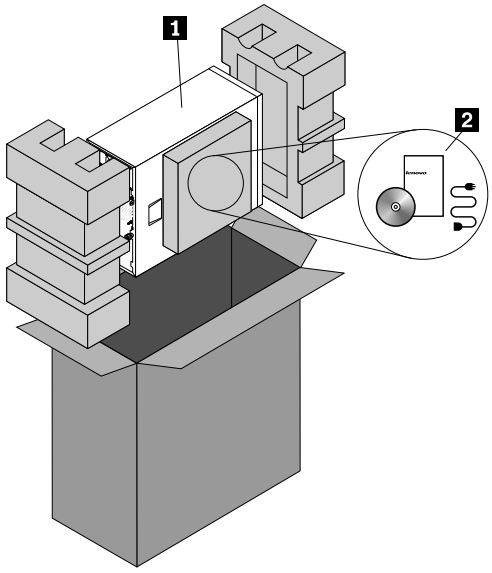

Figure 1. Server package

1 Server

2 Material box (including power cords, printed documentation, a documentation DVD, and software media)

Features

This topic provides general information about the server features for various models. Depending on your specific model, some features might vary or not be available. For information about your specific model, use the Setup Utility program. See “Viewing information in the Setup Utility program” on page 47. You also can

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refer to the *Personal Systems Reference* document for ThinkServer products at:
http://www.lenovo.com/psref/

Microprocessor

One Intel® Xeon® microprocessor (internal cache size varies by model)

For a list of ThinkServer microprocessor options, go to:
http://www.lenovo.com/thinkserver

Memory

Your server has four memory slots. For more information, see “Memory module installation rules” on page 74.

Power supply

Your server comes with one of the following power supply configurations:

- One screw-secured, non-hot-swap 450-watt power supply assembly
- One or two hot-swap 450-watt redundant power supplies

Fans

Your server comes with the following fans to provide proper system cooling and airflow:

- One heat sink and fan assembly
- Two front system fans
- One rear system fan

Internal drives

Internal drives are devices that your server uses to read and store data. The internal drives supported by your server vary by model.

- Hard disk drive
  - Five to eight 3.5-inch hot-swap Serial Advanced Technology Attachment (SATA) or Serial Attached SCSI (SAS) hard disk drives (SCSI is the acronym for Small Computer System Interface)
  - Up to eight 2.5-inch hot-swap SAS hard disk drives
  - Up to four 3.5-inch hot-swap SATA or SAS hard disk drives
  - Up to four 2.5-inch SATA solid-state drives
  - Up to four 3.5-inch non-hot-swap SATA hard disk drives

  Notes:

  - The term “2.5-inch hot-swap hard disk drives” or “2.5-inch hard disk drives” hereinafter refers to all the supported types of 2.5-inch hard disk drives, including the solid-state drives.
  - For server models with more than four SATA hard disk drives or server models that use SAS hard disk drives, there must be a RAID card installed. See “RAID card” on page 30.
- Optical drive
  - Up to two 5.25-inch SATA optical drives
  - The server has two optical drive bays. The lower optical drive bay is installed with a 5.25-inch SATA optical drive.

Note: If the server has only one optical drive installed, ensure that the optical drive is installed in the lower bay (optical drive bay 1). The upper bay is for a secondary optical drive only.

- RDX drive

  Your server supports internal RDX drives that enable you to store data on RDX media. An internal RDX drive is installed in the optical drive bay 2. To install or remove an internal RDX drive, see “Installing or replacing an internal RDX drive” on page 103.

  Note: If your server is installed with a Windows Server operating system, you can use the Windows Backup program to backup the data stored on RDX media. For detailed information, refer to the user guide of the RDX drive. The user guide is available for download at: http://www.lenovo.com/UserManuals

For the location information about the internal drives or drive bays, see “Server components” on page 23.

Expansion slots

The server has four expansion slots on the system board. For detailed information, see “System board components” on page 39.

Input/Output (I/O) features

- One Video Graphics Array (VGA) DB-15 connector on the rear panel
- Eight USB connectors (two USB 3.0 connectors on the front panel; four USB 3.0 and two USB 2.0 connectors on the rear panel)
- One RJ-45 Ethernet connector on the rear panel
- One serial connector on the rear panel

For the location information about the connectors, refer to the related topics in “Locations” on page 12.

Ethernet connectivity

The server comes with an integrated Intel Gigabit Ethernet controller as well as an Ethernet physical layer (PHY) of the Open Systems Interconnection model (OSI model). They provide the server with the ability to support the Ethernet connector on the rear panel with 10 megabits per second (Mbps), 100 Mbps, or 1000 Mbps network connectivity. For more information, see “Rear view of the server” on page 17.

Reliability, availability, and serviceability

Reliability, availability, and serviceability (hereinafter referred to as RAS) are three important server design features. The RAS features help you to ensure the integrity of the data stored on the server, the availability of the server when you need it, and the ease with which you can diagnose and correct problems.

Your server has the following RAS features:

- **Security features**
  - Server locks (see “Server locks” on page 20)
  - Administrator password and power-on password to help protect unauthorized access to the server (see “Using passwords” on page 51)
  - ThinkServer Trusted Platform Module (TPM), which is a security chip, to help enhance server security
  - Hot-swap redundant power supplies to help avoid significant interruption to the operation of the system when a power supply fails (available in some models)
- **Basic system management features**

- Ability to store the power-on self-test (POST) hardware test results
- BIOS Setup Utility program

  The BIOS Setup Utility program helps you view the server information and configure the server in the pre-operating system environment. See “Using the Setup Utility program” on page 47.
- Hot-swap feature

  Some models support hot-swap hard disk drives and hot-swap redundant power supplies. With the hot-swap feature, you can install, remove, or replace hard disk drives or a failing power supply without turning off the server.
- Preboot Execution Environment (PXE)

  The Intel PXE technology enables you to start your computers, load an operating system, or deploy executable images from a remote server by using a network interface. The operation can be done independently of local data storage devices (such as hard disk drives) or installed operating systems.
- Redundant Array of Independent Disks (RAID)

  Your server supports onboard SATA software RAID. If a required RAID card is installed, your server also supports advanced SATA/SAS hardware RAID configurations. For detailed information, see “Configuring RAID” on page 57.
- Status light-emitting diodes (LEDs) and diagnostic LEDs

  For more information about the LEDs for your server, refer to the related topics in “Locations” on page 12.
- Software programs

  For more information about the software programs, see “Software” on page 11.

Specifications

This topic lists the physical specifications for your server.

Dimensions

Width: 195 mm (7.68 inches)

Height: 430 mm (16.93 inches) without foot stands; 445 mm (17.52 inches) with foot stands

Depth: 595 mm (23.43 inches) including the front bezel

Weight

The product weight varies depending on different system configurations.

Range of product weight without package: 19 kg (41.89 lb) to 28 kg (61.73 lb)

Range of product package weight: 2.8 kg (6.17 lb) to 3.5 kg (7.72 lb)

Environment

- Air temperature:

  Operating: 10°C to 35°C (50°F to 95°F)

  Storage: -40°C to 70°C (-40°F to 158°F) in original shipping package
- Altitude: 0 to 3048 m (0 to 10 000 ft)
- Humidity:

  Operating: 10% to 80% (non-condensing)

  Storage: 10% to 90% (non-condensing)

Electrical input

Universal input:

Minimum: 90 V ac

Maximum: 264 V ac

Input frequency range: 47 to 63 Hz

Software

This topic provides information about the software programs that you can use to set up, use, and maintain the server.

ThinkServer EasyStartup

The ThinkServer EasyStartup program simplifies the process of configuring RAID and installing supported Microsoft Windows and Linux operating systems and device drivers on your server. This program is provided with your server on a self-starting (bootable) *ThinkServer EasyStartup* DVD. The user guide for the program is also on the DVD and can be accessed directly from the program interface. For detailed information, see “Using the ThinkServer EasyStartup program” on page 54.

ThinkServer EasyUpdate Firmware Updater

The ThinkServer EasyUpdate Firmware Updater program (hereinafter referred to as the Firmware Updater program) enables you to maintain your server firmware up to date and helps you avoid unnecessary server outages. The Firmware Updater program is provided on the Lenovo Support Web site. For more information about downloading and using the Firmware Updater program, see “Updating the firmware” on page 62.

BIOS update utilities

The BIOS firmware keeps updating after the shipment of the server. Lenovo maintains pages on the Support Web site and provides the BIOS update utilities with instructions for download to help you update the BIOS if needed. For more information, see “Updating or recovering the BIOS” on page 53 and “Updating the firmware” on page 62.

RAID configuration utilities

Your server supports onboard SATA software RAID. If a required RAID card is installed, your server also supports advanced SATA/SAS hardware RAID configurations. For detailed information, see “Configuring RAID” on page 57.

Diagnostic programs

The following diagnostic programs are available for you to diagnose server problems:

- ThinkServer Diagnostic Tool
- ThinkServer System Profile Collection Tool

For more information, see “Using a diagnostic program” on page 167.

Locations

This topic provides information to help you locate your server components.

Machine type, model, and serial number label

This topic helps you locate the two labels that contain the machine type, model, and serial number information for your server. The two labels are the same. One is on the front bezel and the other is on the chassis.

The machine type, model, and serial number identify your server. When you contact Lenovo for help, the information helps support technicians to identify your server and provide faster service.

The following illustration is a sample of the machine type, model, and serial number labels on the server.

Note: Depending on the model, your server might look slightly different from the illustration in this topic.

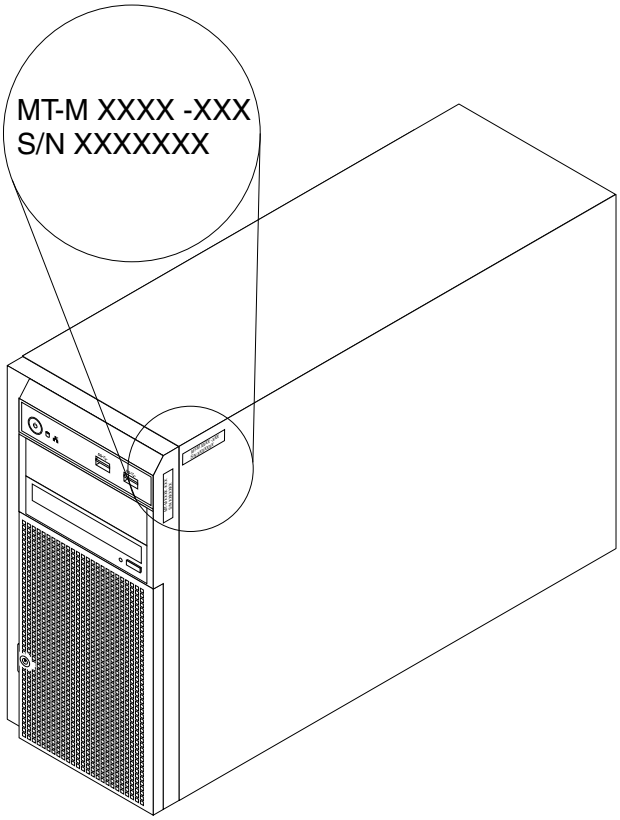


Figure 2. Machine type, model, and serial number labels

Front view of the server

This topic provides information to help you locate the parts on the front of the server.

The following illustration shows the front view of the server.

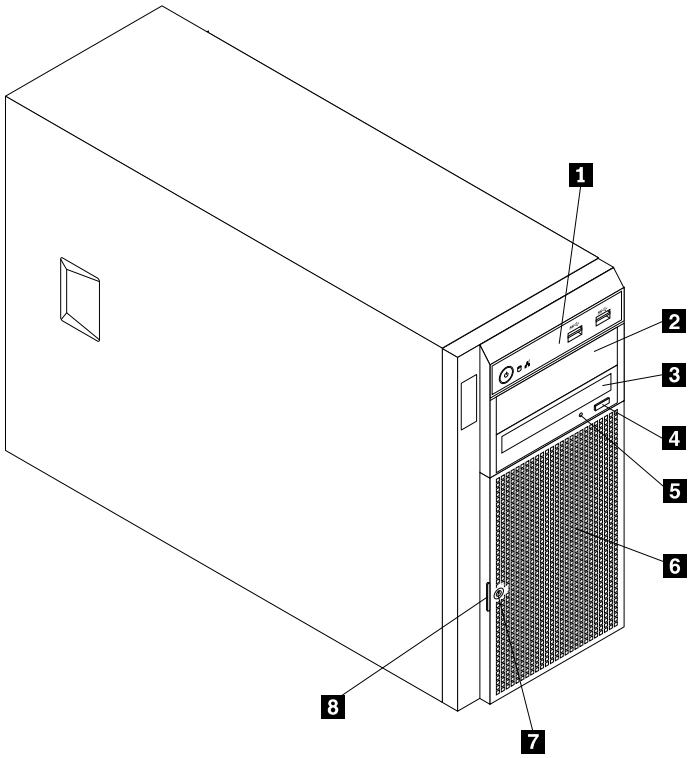


Figure 3. Front view of the server

1 Front panel	5 Optical drive status LED
2 Optical drive bay 2 (with an optical drive installed in some models)	6 Front door
3 Optical drive bay 1 (with an optical drive installed)	7 Front door lock
4 Optical drive eject/close button	8 Front door handle

1 Front panel

For detailed information about the control, connectors, and status LEDs on the front panel, see “Front panel” on page 16.

2 Optical drive bay 2

The 5.25-inch optical drive bay 2 is for a secondary optical drive. Some models have a secondary optical drive installed.

3 Optical drive bay 1

Your server comes with an optical drive installed in the 5.25-inch optical drive bay 1.

4 Optical drive eject/close button

Press this button to eject or close the optical drive when the server power is on.

5 Optical drive status LED

The optical drive status LED is blinking in green when the optical drive is working or in the POST process.

6 Front door

7 Front door lock

You can lock the front door to protect the hard-disk-drive cages from unauthorized access.

8 Front door handle

Use the front door handle to open the front door.

Front panel

This topic provides information to help you locate the control, connectors, and LEDs on the front panel of the server.

The following illustration shows the control, connectors, and LEDs on the front panel of the server.

Note: Depending on the model, your server might look slightly different from the following illustration.

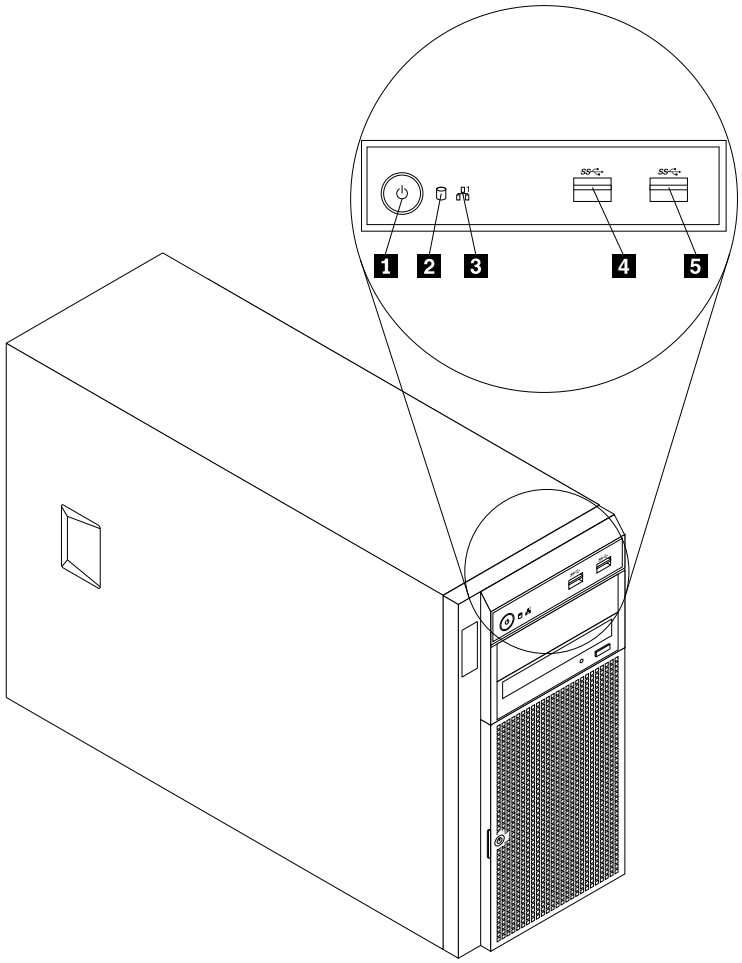


Figure 4. Front panel

1 Power button with power status LED	4 Front USB 3.0 connector 1
2 Hard-disk-drive status LED	5 Front USB 3.0 connector 2
3 Network Interface Controller (NIC) status LED	

1 Power button with power status LED

Press the power button to turn on the server when you finish setting up the server. You also can hold the power button for several seconds to turn off the server if you cannot turn off the server from the operating system. See Chapter 4 “Turning on and turning off the server” on page 45. The power status LED helps you to determine the current power status.

Power status LED	Color	Description
On	Green	The server is on.
Off	None	The server is off.

2 Hard-disk-drive status LED

The hard-disk-drive status LED helps you to determine the status of the hard-disk-drive activity.

Note: The hard-disk-drive status LED is available on server models without a discrete RAID card installed.

Hard-disk-drive status LED	Color	Description
Off	None	The hard disk drive is not in use.
Blinking	Green	The hard disk drive is active and data is being transferred.

3 NIC status LED

The NIC status LED indicates the LAN status for the Ethernet connector on the rear panel of the server.

NIC status LED	Color	Description
On	Green	The server is connected to a LAN.
Off	None	The server is disconnected from a LAN.
Blinking	Green	The LAN is connected and active.

4 Front USB 3.0 connector 1

5 Front USB 3.0 connector 2

Used to attach a USB-compatible device, such as a USB keyboard, mouse, scanner, or printer. If you have more than eight USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.

Rear view of the server

This topic provides information to help you locate the connectors and components on the rear of your server.

The following illustration shows the rear view of the server with a screw-secured, non-hot-swap power supply assembly.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

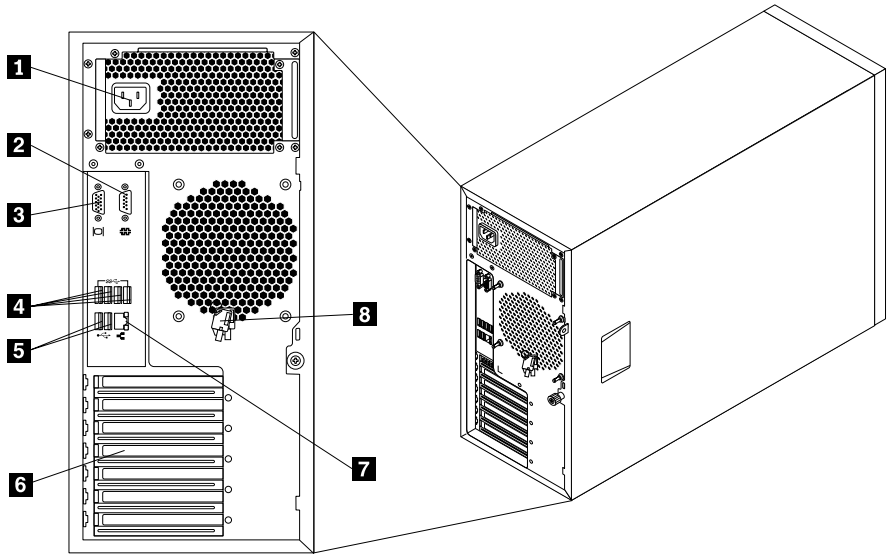


Figure 5. Rear view of the server with a non-hot-swap power supply assembly

1 Power cord connector	5 USB 2.0 connectors (2)
2 Serial connector	6 Expansion card area
3 VGA DB-15 connector	7 Ethernet connector (RJ-45)
4 USB 3.0 connectors (4)	8 Front door key

Your server model might have one or two hot-swap redundant power supplies. Each hot-swap redundant power supply has one power cord connector **1** on the rear of the server. For each hot-swap redundant power supply, there might be one or two status LEDs on the power supply near the power cord connector. When the LED is lit in green, it indicates that the hot-swap redundant power supply is working correctly. When the LED is lit in amber, it indicates that the hot-swap redundant power supply is likely to fail or has failed.

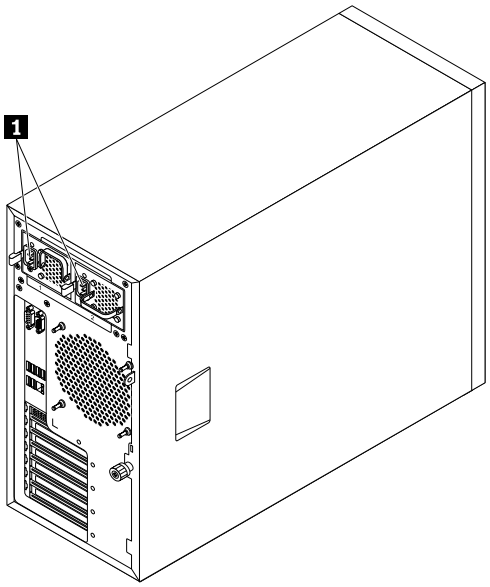


Figure 6. Rear view of the server with hot-swap redundant power supplies

1 Power cord connectors

Used to connect the power cords.

2 Serial connector

Used to attach a device that uses a 9-pin serial connector.

3 VGA DB-15 connector

Used to attach a VGA-compatible video device, such as a VGA monitor.

4 USB 3.0 connectors (4)

5 USB 2.0 connectors (2)

Used to attach a USB-compatible device, such as a USB keyboard, mouse, scanner, or printer. If you have more than eight USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.

6 Expansion card area

Your server has four expansion slots on the system board for you to install appropriate Peripheral Component Interconnect (PCI) cards or PCI Express cards. For detailed information, see “System board components” on page 39.

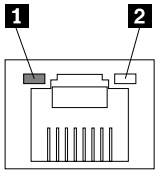
Note: If a ThinkServer Host Bus Adapter (HBA) is available, refer to its user guide and the below table for detailed information. The user guide is available for download at:
http://www.lenovo.com/UserManuals

Table 1. Supported HBA

Physical link width	Negotiable link width	Supported card length and height
x8	x4, x2, x1	Low-profile card

7 Ethernet connector (RJ-45)

Used to attach an Ethernet cable for a LAN. The Ethernet connector has two status LEDs to help you identify the Ethernet connectivity, activity, and connection speed.



Ethernet status LED	Color	Status	Description
2 Right	Amber	On	The server is connected to a LAN.
		Off	The server is disconnected from a LAN.
		Blinking	The LAN is connected and active.
1 Left	Amber	On	The connection speed is 1000 Mbps.
	Green	On	The connection speed is 100 Mbps.
	None	Off	The connection speed is 10 Mbps.

8 Front door key

Used to open or lock the front door.

Note: Carefully save the front door key to avoid loss.

Server locks

Locking the server cover prevents unauthorized access to the inside of your server. Locking the front door prevents unauthorized access to the installed hard disk drives.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

Padlock

Your server comes with a padlock loop. When a padlock is installed, the server cover cannot be removed.

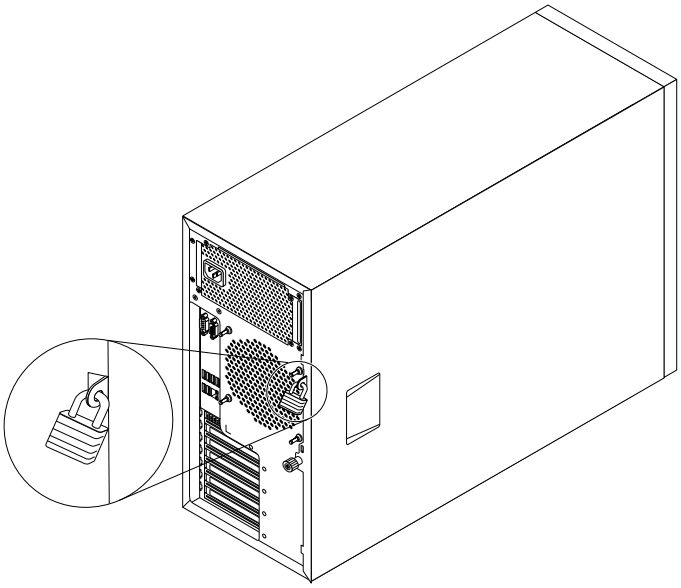


Figure 7. Padlock

Kensington-style cable lock

You can use a Kensington-style cable lock to secure your server to a desk, table, or other non-permanent fixture. The cable lock attaches to the security-lock slot at the rear of your server and is operated with a key or combination depending on the type selected. The cable lock also locks the server cover. This is the same type of lock used with many notebook computers. You can order such a cable lock directly from Lenovo by searching for **Kensington** at:
http://www.lenovo.com/support

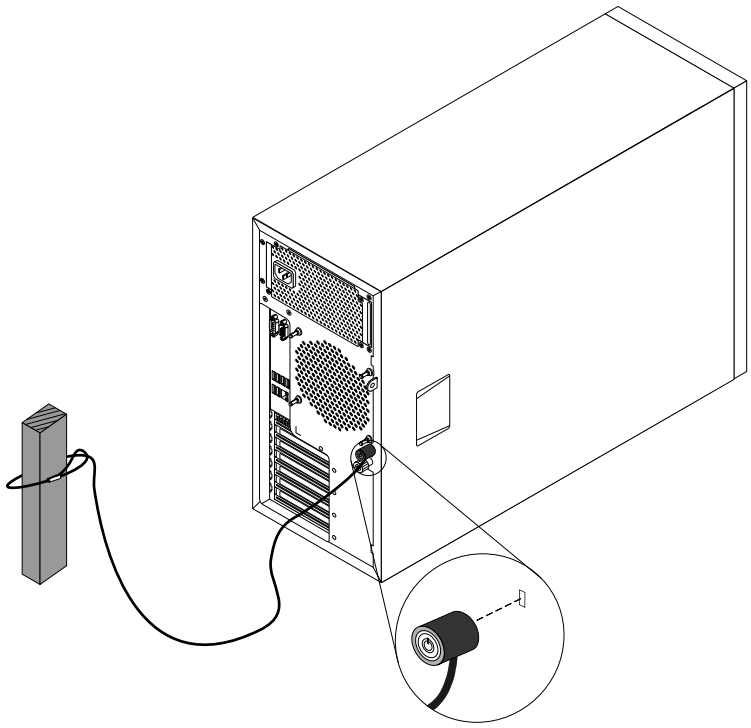


Figure 8. Kensington-style cable lock

Front door lock

You can remove the key attached on the rear of the server and use it to open or lock the front door of the server. The front door protects the hard-disk-drive cages and prevents unauthorized access to the installed hard disk drives.

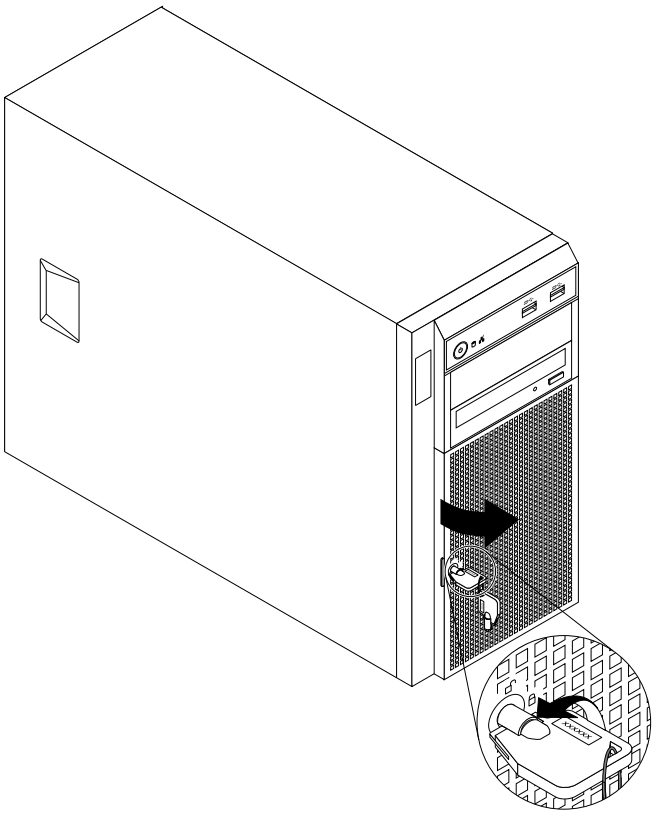


Figure 9. Front door lock

Server components

This topic provides information to help you locate the components of your server. For more information about major components, see the related topics in “Locations” on page 12.

To remove the server cover and gain access to the inside of the server, see “Removing the server cover” on page 67.

The chassis configuration varies by model. The following illustrations show the four main chassis configurations based on the supported hard disk drives.

- “Components of server models with four 3.5-inch hot-swap hard-disk-drive bays” on page 24.
- “Components of server models with eight 3.5-inch hot-swap hard-disk-drive bays” on page 25.
- “Components of server models with eight 2.5-inch hot-swap hard-disk-drive bays” on page 26.
- “Components of server models with four 3.5-inch non-hot-swap hard-disk-drive bays” on page 27.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

Components of server models with four 3.5-inch hot-swap hard-disk-drive bays

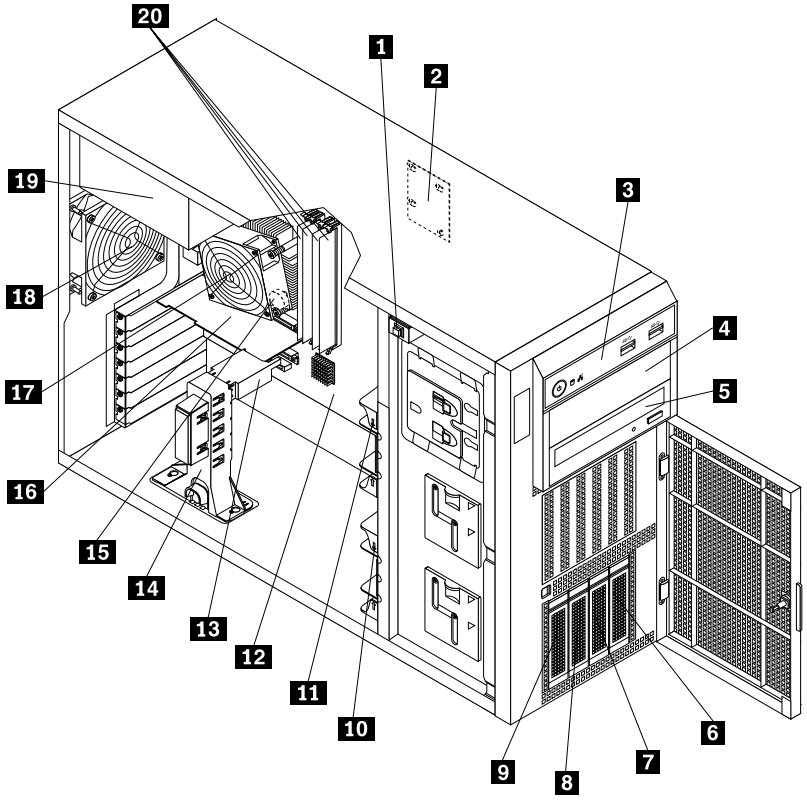


Figure 10. Components of server models with four 3.5-inch hot-swap hard-disk-drive bays

1 Cover presence switch	11 Front system fan 2
2 Power conversion board	12 System board
3 Front panel	13 Low-profile PCI card bracket
4 Optical drive bay 2 (with an optical drive installed in some models)	14 Main PCI card bracket
5 Optical drive bay 1 (with an optical drive installed)	15 System board battery
6 Hard-disk-drive bay 3	16 Expansion card
7 Hard-disk-drive bay 2	17 Heat sink and fan assembly
8 Hard-disk-drive bay 1	18 Rear system fan
9 Hard-disk-drive bay 0	19 Power supply
10 Front system fan 1	20 Four memory slots (installed memory modules vary by model)

Note: The power conversion board 2, low-profile PCI card bracket 13, and main PCI card bracket 14 are available in server models that come with a RAID card.

Components of server models with eight 3.5-inch hot-swap hard-disk-drive bays

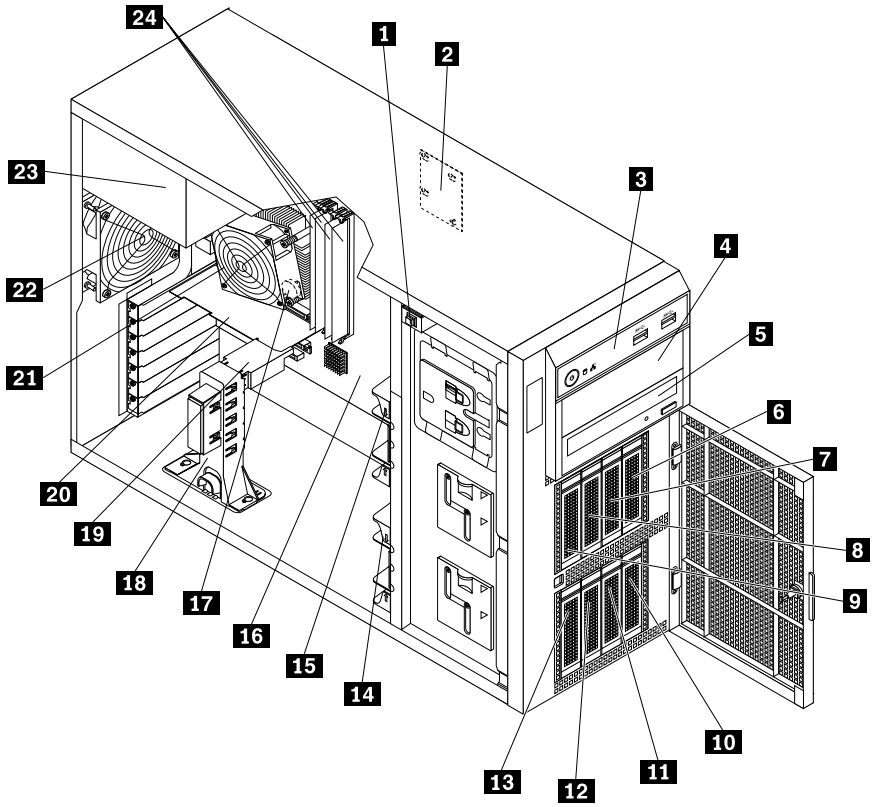


Figure 11. Components of server models with eight 3.5-inch hot-swap hard-disk-drive bays

1 Cover presence switch	13 Hard-disk-drive bay 0
2 Power conversion board	14 Front system fan 1
3 Front panel	15 Front system fan 2
4 Optical drive bay 2 (with an optical drive installed in some models)	16 System board
5 Optical drive bay 1 (with an optical drive installed)	17 System board battery
6 Hard-disk-drive bay 7	18 Main PCI card bracket
7 Hard-disk-drive bay 6	19 Low-profile PCI card bracket
8 Hard-disk-drive bay 5	20 Expansion card
9 Hard-disk-drive bay 4	21 Heat sink and fan assembly
10 Hard-disk-drive bay 3	22 Rear system fan
11 Hard-disk-drive bay 2	23 Power supply
12 Hard-disk-drive bay 1	24 Four memory slots (installed memory modules vary by model)

Note: The power conversion board 2, low-profile PCI card bracket 19, and main PCI card bracket 18 are available in server models that come with a RAID card.

Components of server models with eight 2.5-inch hot-swap hard-disk-drive bays

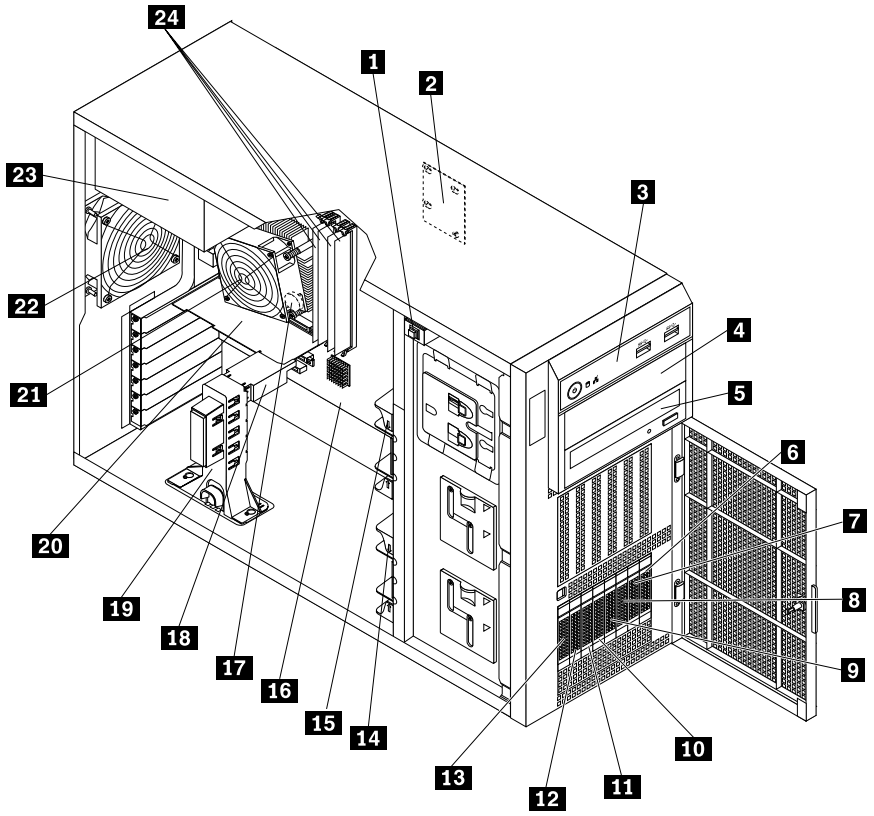


Figure 12. Components of server models with eight 2.5-inch hot-swap hard-disk-drive bays

1 Cover presence switch	13 Hard-disk-drive bay 0
2 Power conversion board	14 Front system fan 1
3 Front panel	15 Front system fan 2
4 Optical drive bay 2 (with an optical drive installed in some models)	16 System board
5 Optical drive bay 1 (with an optical drive installed)	17 System board battery
6 Hard-disk-drive bay 7	18 Low-profile PCI card bracket
7 Hard-disk-drive bay 6	19 Main PCI card bracket
8 Hard-disk-drive bay 5	20 Expansion card
9 Hard-disk-drive bay 4	21 Heat sink and fan assembly
10 Hard-disk-drive bay 3	22 Rear system fan
11 Hard-disk-drive bay 2	23 Power supply
12 Hard-disk-drive bay 1	24 Four memory slots (installed memory modules vary by model)

Note: The power conversion board 2, low-profile PCI card bracket 18, and main PCI card bracket 19 are available in server models that come with a RAID card.

Components of server models with four 3.5-inch non-hot-swap hard-disk-drive bays

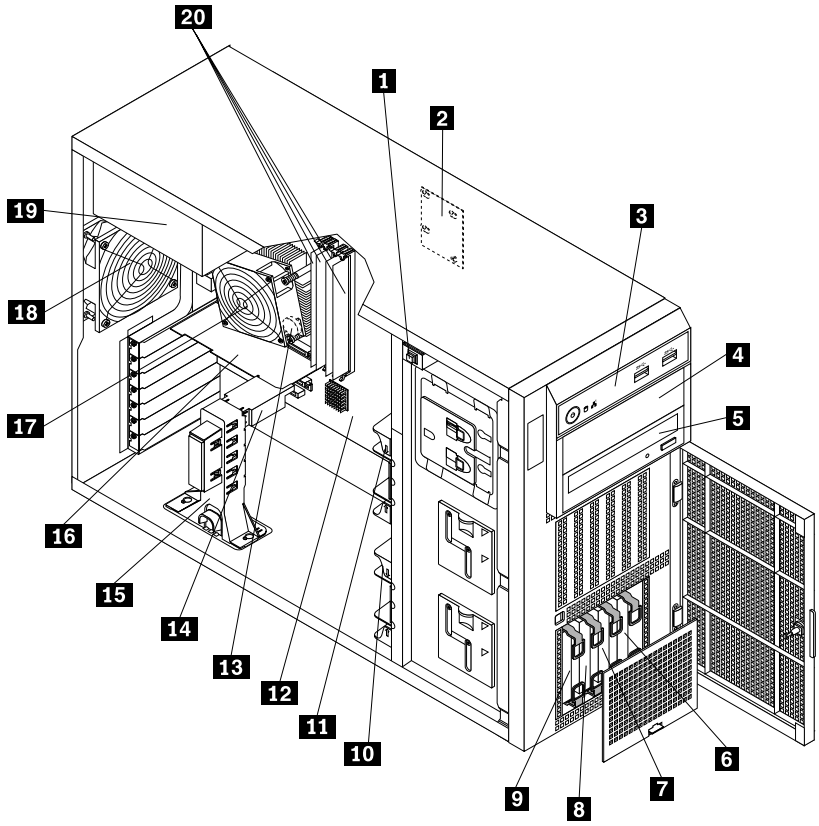


Figure 13. Components of server models with four 3.5-inch non-hot-swap hard-disk-drive bays

1 Cover presence switch	11 Front system fan 2
2 Power conversion board	12 System board
3 Front panel	13 System board battery
4 Optical drive bay 2 (with an optical drive installed in some models)	14 Low-profile PCI card bracket
5 Optical drive bay 1 (with an optical drive installed)	15 Main PCI card bracket
6 Hard-disk-drive bay 3	16 Expansion card
7 Hard-disk-drive bay 2	17 Heat sink and fan assembly
8 Hard-disk-drive bay 1	18 Rear system fan
9 Hard-disk-drive bay 0	19 Power supply
10 Front system fan 1	20 Four memory slots (installed memory modules vary by model)

Note: The power conversion board 2, low-profile PCI card bracket 14, and main PCI card bracket 15 are available in server models that come with a RAID card.

CRU identification

CRUs are parts that can be upgraded or replaced by the customer. If a CRU is determined to be defective during the warranty period, a replacement CRU will be provided to the customer. Customers are responsible for installing the self-service CRUs for this product. Customers also can install optional-service CRUs, which

might require some technical skills or tools, or request that a technician install the optional-service CRU under the terms of the applicable warranty service type for your country or region.

Non-CRUs must be replaced only by trained service technicians.

The following table lists the major FRUs in your server and the CRU identification information. For a complete listing of FRU information, such as FRU part numbers and supported server models, go to: http://www.lenovo.com/serviceparts-lookup

Notes:

- Before servicing a Lenovo product, ensure that you read and understand “Safety information” on page iii.
- Use only parts provided by Lenovo.

Description	Self-service CRU	Optional-service CRU
Front panel board assembly	No	Yes
Front system fan	Yes	No
Heat sink and fan assembly	Yes	No
Hot-swap hard disk drive	Yes	No
Hot-swap hard disk drive backplane (available in some models)	No	Yes
Hot-swap redundant power supply (available in some models)	Yes	No
Keyboard	Yes	No
Memory module	Yes	No
Microprocessor	No	Yes
Mouse	Yes	No
Non-hot-swap power supply assembly (available in some models)	No	Yes
Optical drive	Yes	No
Peripheral Component Interconnect (PCI) card (available in some models)	Yes	No
Power conversion board	No	Yes
Power distribution board and cage assembly (available in models with hot-swap redundant power supplies)	No	Yes
Rear system fan	Yes	No
System board	No	No
System board battery	Yes	No
ThinkServer RAID 500 Upgrade Key for Advanced RAID (available as an option)	Yes	No
ThinkServer RAID 700 Battery (available as an option)	No	Yes

Hot-swap hard-disk-drive status LEDs

This topic applies only to server models with hot-swap hard disk drives.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

Each hot-swap hard disk drive has two status LEDs on the front. Unlock and open the front door to access the hard disk drives and view the status LEDs.

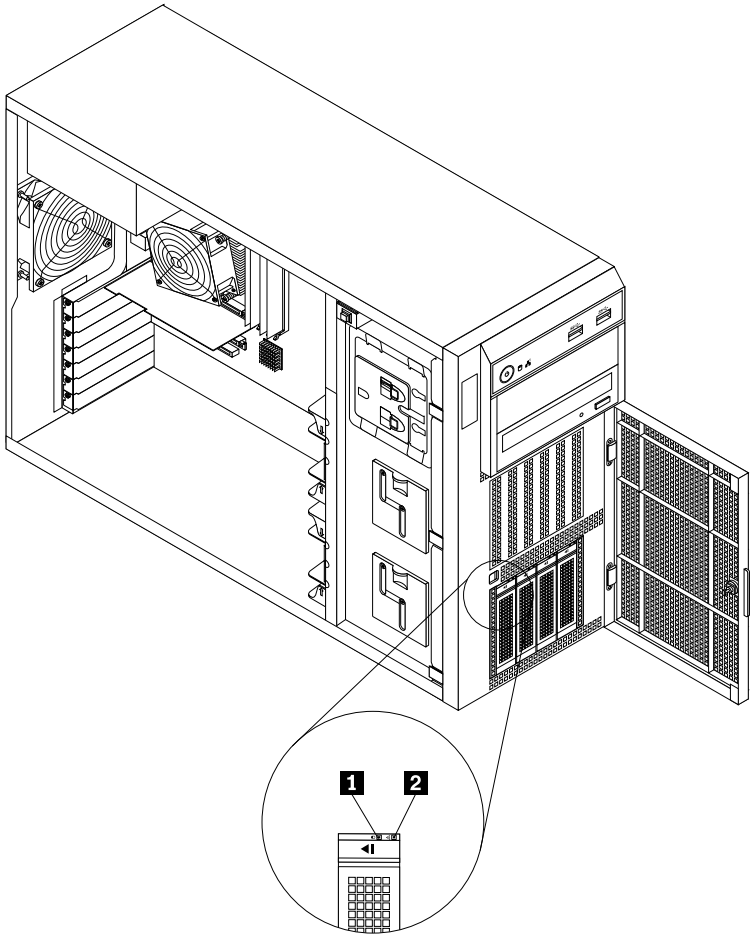


Figure 14. 3.5-inch hot-swap hard-disk-drive status LEDs

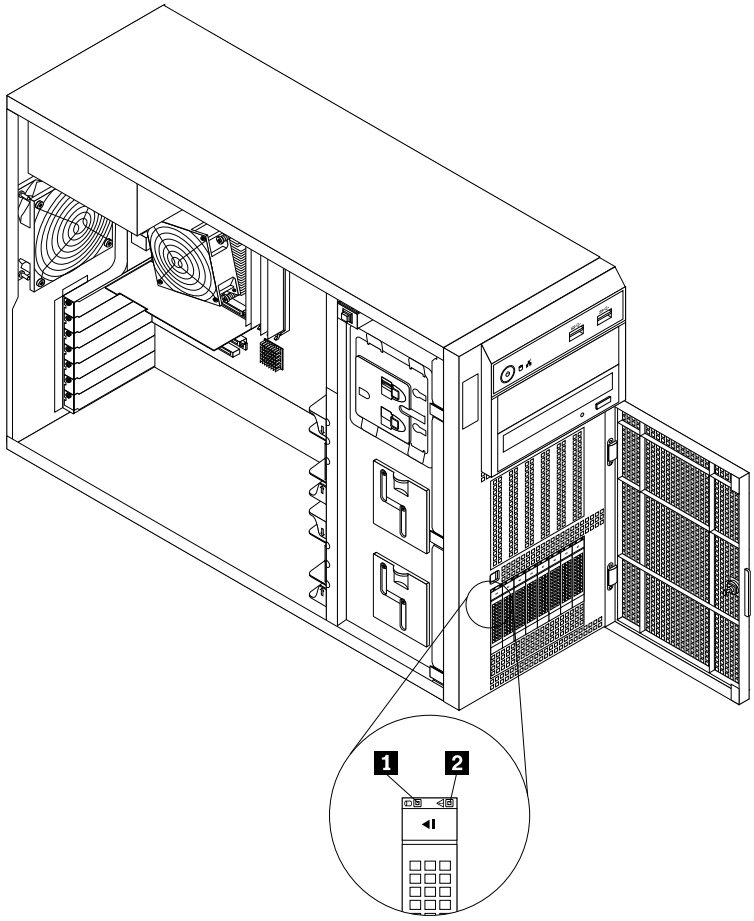


Figure 15. 2.5-inch hot-swap hard-disk-drive status LEDs

1 Hard-disk-drive activity LED	2 Hard-disk-drive RAID status LED	Description
Off	Off	The hard disk drive has failed or is not present.
On, green	Off	The hard disk drive is present but not in use.
Blinking, green	Off	The hard disk drive is active and data is being transferred.
On, green	Blinking rapidly (about four flashes per second), amber	The RAID controller is locating the hard disk drive.
On, green	On, amber	The RAID array has failed and cannot recover.
Blinking, green	Blinking slowly (about one flash per second), amber	The hard disk drive is being rebuilt.

RAID card

This topic provides information to help you locate the connectors on a RAID card if a RAID card is installed in the PCI-E slot 1 on the system board. See “System board components” on page 39.

Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. If your server does not come with a RAID card, you can purchase one from Lenovo. See “Installing or removing the RAID card” on page 82.

Notes:

- The option kit for the RAID card is designed for different types of servers and might contain additional cables that are not required for your server.
- For server models with more than four SATA hard disk drives or models that use SAS hard disk drives, there must be a RAID card installed.

Your server supports the following RAID cards:

- ThinkServer RAID 500 Adapter
- ThinkServer RAID 700 Adapter

ThinkServer RAID 500 Adapter

The following illustration shows the connectors on the ThinkServer RAID 500 Adapter.

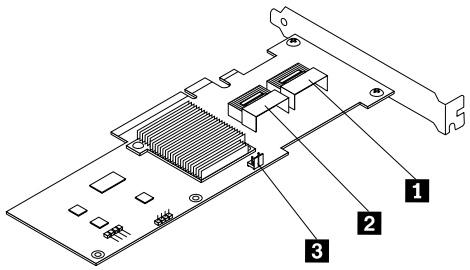


Figure 16. ThinkServer RAID 500 Adapter

1 Port 0	3 TR 500 key connector
2 Port 1	

1 Port 0

Used to connect a mini-SAS signal cable. See “Connecting the cables” on page 36.

2 Port 1

Used to connect a mini-SAS signal cable. See “Connecting the cables” on page 36.

3 TR 500 key connector

Used to connect a ThinkServer RAID 500 Upgrade Key for Advanced RAID. See “Installing or removing the ThinkServer RAID 500 Upgrade Key for Advanced RAID” on page 84.

ThinkServer RAID 700 Adapter

The following illustration shows the connectors on the ThinkServer RAID 700 Adapter.

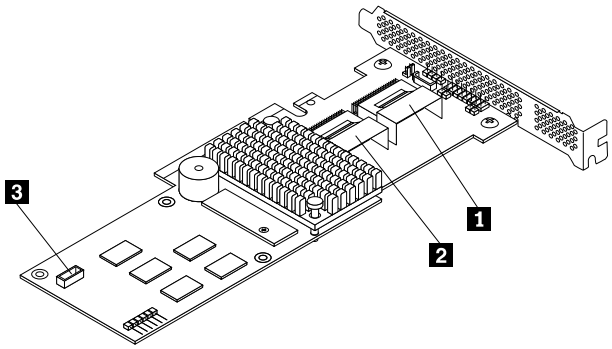


Figure 17. ThinkServer RAID 700 Adapter

1 Ports 7-4	3 ThinkServer RAID 700 Battery connector
2 Ports 3-0	

1 Ports 7-4

Used to connect a mini-SAS signal cable. See “Connecting the cables” on page 36.

2 Ports 3-0

Used to connect a mini-SAS signal cable. See “Connecting the cables” on page 36.

3 ThinkServer RAID 700 Battery connector

Used to connect a ThinkServer RAID 700 Battery. See “Installing or removing the ThinkServer RAID 700 Battery” on page 88.

Hot-swap hard-disk-drive backplane

Your server might come with one of the following hot-swap hard disk drive and backplane configurations:

- Five to eight 3.5-inch hot-swap SATA or SAS hard disk drives with two backplanes
- Up to four 3.5-inch hot-swap SATA or SAS hard disk drives with one backplane
- Up to eight 2.5-inch hot-swap SAS hard disk drives with one backplane

The following illustration shows the locations of the hot-swap hard-disk-drive backplanes **1**. You need to open the server cover and remove the front system fans to access the backplanes. See “Removing the server cover” on page 67 and “Replacing the front system fan 1” on page 144.

Notes:

- Depending on the model, your server might look slightly different from the illustration in this topic.
- The following illustration is based on server models that have five to eight 3.5-inch hot-swap SATA or SAS hard disk drives with two backplanes.

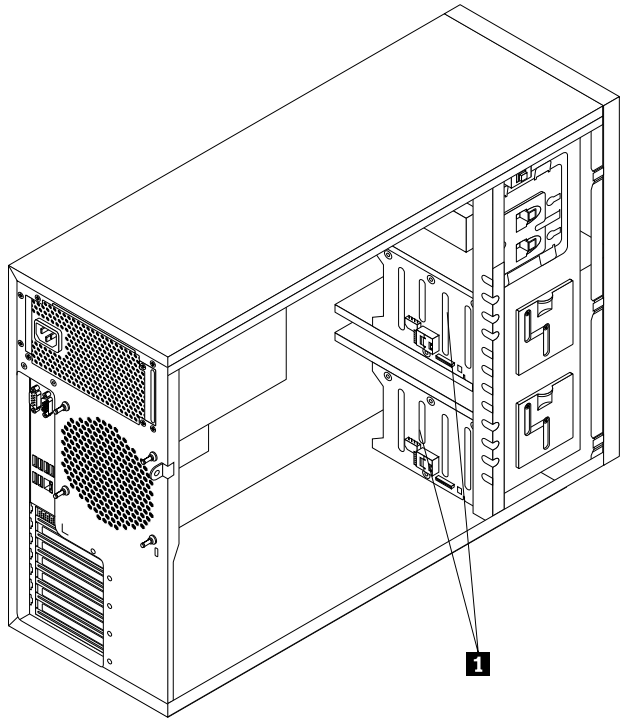


Figure 18. Hot-swap hard-disk-drive backplane locations

Backplane for server models with four 3.5-inch hot-swap hard-disk-drive bays

This topic provides information to help you locate the connectors on the backplane for server models with four 3.5-inch hot-swap hard-disk-drive bays.

The following illustrations show the connectors on the backplane for server models with four 3.5-inch hot-swap hard-disk-drive bays.

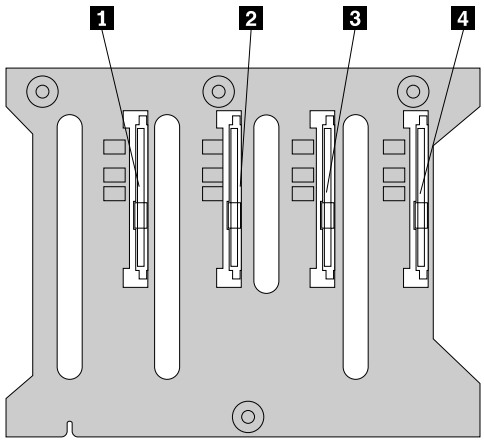


Figure 19. Front view of the backplane for server models with four 3.5-inch hot-swap hard-disk-drive bays

1 Slot 0 for a 3.5-inch SATA or SAS hot-swap hard disk drive	**3** Slot 2 for a 3.5-inch SATA or SAS hot-swap hard disk drive
2 Slot 1 for a 3.5-inch SATA or SAS hot-swap hard disk drive	**4** Slot 3 for a 3.5-inch SATA or SAS hot-swap hard disk drive

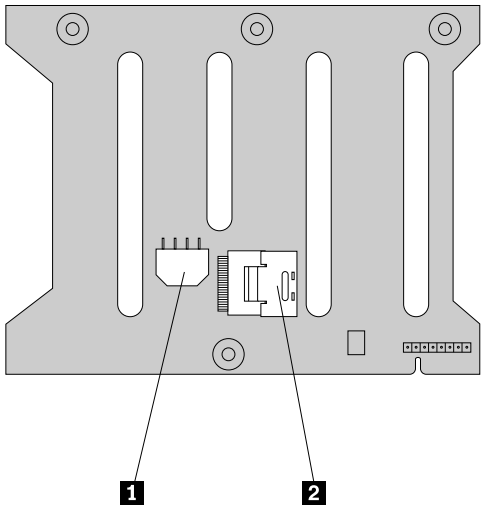


Figure 20. Rear view of the backplane for server models with four 3.5-inch hot-swap hard-disk-drive bays

1 8-pin power connector

Used to connect a power cable.

2 Mini-SAS signal cable connector

Used to connect the mini-SAS connector on one end of the mini-SAS signal cable.

Backplane for server models with eight 2.5-inch hot-swap hard-disk-drive bays

This topic provides information to help you locate the connectors on the backplane for server models with eight 2.5-inch hot-swap hard-disk-drive bays.

The following illustrations show the connectors on the backplane for server models with eight 2.5-inch hot-swap hard-disk-drive bays.

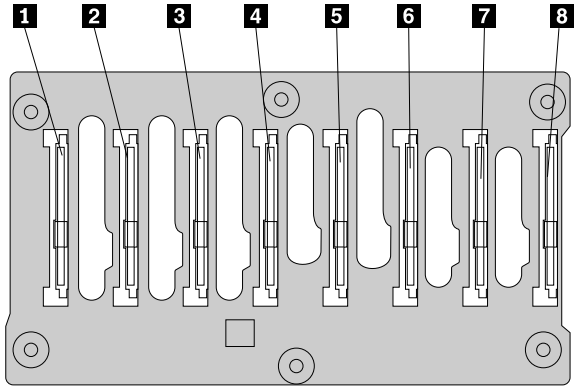


Figure 21. Front view of the backplane for server models with eight 2.5-inch hot-swap hard-disk-drive bays

1 Slot 0 for a 2.5-inch SAS hot-swap hard disk drive	**5** Slot 4 for a 2.5-inch SAS hot-swap hard disk drive
2 Slot 1 for a 2.5-inch SAS hot-swap hard disk drive	**6** Slot 5 for a 2.5-inch SAS hot-swap hard disk drive
3 Slot 2 for a 2.5-inch SAS hot-swap hard disk drive	**7** Slot 6 for a 2.5-inch SAS hot-swap hard disk drive
4 Slot 3 for a 2.5-inch SAS hot-swap hard disk drive	**8** Slot 7 for a 2.5-inch SAS hot-swap hard disk drive

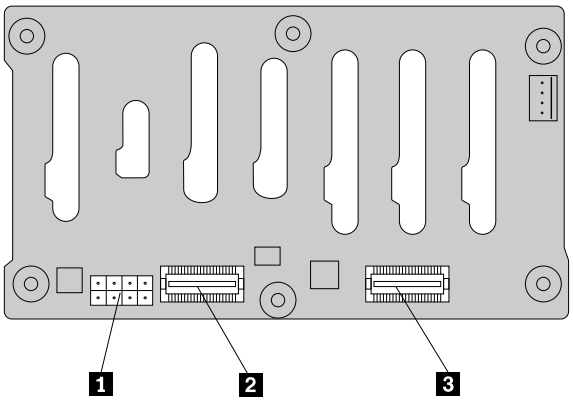


Figure 22. Rear view of the backplane for server models with eight 2.5-inch hot-swap hard-disk-drive bays

1 8-pin power connector

Used to connect a power cable.

2 Mini-SAS signal cable connector 1

Used to connect the mini-SAS connector on one end of the mini-SAS signal cable.

3 Mini-SAS signal cable connector 0

Used to connect the mini-SAS connector on one end of the mini-SAS signal cable.

Connecting the cables

This topic provides instructions on the following cable connections:

- "Connecting the mini-SAS signal cable from the system board to the backplane for server models with hot-swap hard disk drives" on page 36.
- "Connecting the mini-SAS signal cables from the RAID card to the backplanes for server models with hot-swap hard disk drives" on page 37.
- "Connecting the SATA signal cables from the system board to the non-hot-swap hard disk drives" on page 39.

Connecting the mini-SAS signal cable from the system board to the backplane for server models with hot-swap hard disk drives

For server models with up to four 3.5-inch SATA hot-swap hard disk drives installed, you can use the mini-SAS signal cable that has four SATA connectors and one Serial General Purpose Input/Output (SGPIO) connector for cable connection.

To connect the mini-SAS signal cable from the system board to the backplane, do the following:

1. Connect the mini-SAS connector 1 to the mini-SAS signal cable connector 0 on the backplane. The backplane is installed on the lower hard-disk-drive cage.
2. Connect the four SATA connectors 3 - 6 to the SATA connectors 0-3 on the system board.
3. Connect the SGPIO connector 2 to the SATA SGPIO connector on the system board.

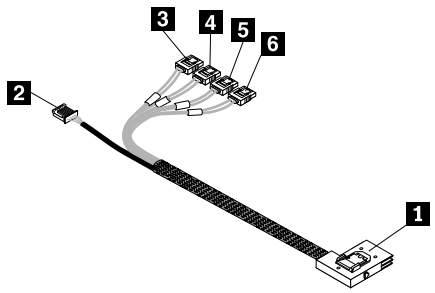


Figure 23. Mini-SAS signal cable with four SATA connectors and one SATA SGPIO connector

To connect the power cable from the system board to the backplane, connect the 4-pin power connector on one end of the power cable to the 4-pin power connector on the system board. Then, connect the other power connector on the other end of the power cable to the power connector on the backplane.

Note: The number on the label for each of the four SATA signal cables indicates the sequence to follow when you are connecting the cables to the corresponding SATA connectors (0-3) on the system board.

SATA signal cable label	System board SATA connector
P0	SATA connector 0
P1	SATA connector 1
P2	SATA connector 2
P3	SATA connector 3

For information about configuring RAID using the configuration utility for the ThinkServer RAID 100, see “Configuring the system BIOS to enable onboard SATA RAID functionality” on page 59.

Refer to the following topics for information about the connector locations:

- “Hot-swap hard-disk-drive backplane” on page 32
- “System board components” on page 39

Connecting the mini-SAS signal cables from the RAID card to the backplanes for server models with hot-swap hard disk drives

If your server has a supported RAID card installed, you can connect the mini-SAS signal cables from the RAID card to the backplanes to support up to eight hard disk drives. In this case, you can configure RAID for the hard disk drives using the advanced hardware RAID functions.

Note: The option package for the RAID card is designed for different types of servers and might contain additional cables that are not required for installation.

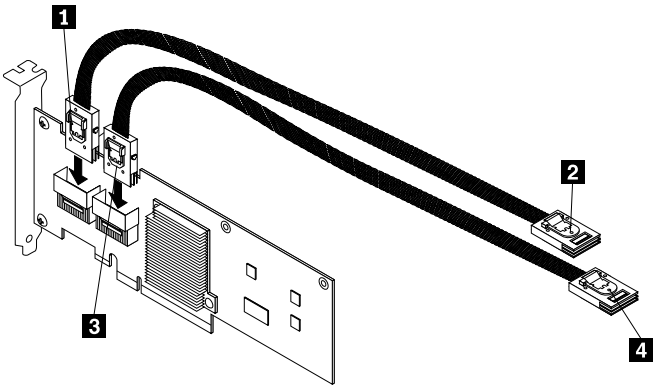


Figure 24. Connecting cables from the RAID card to the backplanes

To connect the mini-SAS signal cables from the RAID card to the backplanes, do the following:

- If you are using a ThinkServer RAID 700 Adapter, do the following:
  1. Use one mini-SAS to mini-SAS signal cable. Connect the mini-SAS connector **3** on one end of the cable to the ports 3-0 on the RAID card. Then, connect the mini-SAS connector **4** on the other end of the cable to the mini-SAS signal cable connector 0 on the backplane for 2.5-inch hard disk drives or to the mini-SAS signal cable connector on the backplane for 3.5-inch hard disk drives. The backplane for 3.5-inch hard disk drives is installed on the lower hard-disk-drive cage.
  2. If your server has more than four hard disk drives installed, use the other mini-SAS to mini-SAS signal cable. Connect the mini-SAS connector **1** on one end of the cable to the ports 7-4 on the RAID card. Then, connect the mini-SAS connector **2** on the other end of the cable to the mini-SAS signal cable connector 1 on the backplane for 2.5-inch hard disk drives or to the mini-SAS signal cable connector on the backplane for 3.5-inch hard disk drives. The backplane for 3.5-inch hard disk drives is installed on the upper hard-disk-drive cage.
- If you are using a ThinkServer RAID 500 Adapter, do the following:
  1. Use one mini-SAS to mini-SAS signal cable. Connect the mini-SAS connector **1** on one end of the cable to the port 0 on the RAID card. Then, connect the mini-SAS connector **2** on the other end of the cable to the mini-SAS signal cable connector 0 on the backplane for 2.5-inch hard disk drives or to the mini-SAS signal cable connector on the backplane for 3.5-inch hard disk drives. The backplane for 3.5-inch hard disk drives is installed on the lower hard-disk-drive cage.
  2. If your server has more than four hard disk drives installed, use the other mini-SAS to mini-SAS signal cable. Connect the mini-SAS connector **3** on one end of the cable to the port 1 on the RAID card. Then, connect the mini-SAS connector **4** on the other end of the cable to the mini-SAS signal cable connector 1 on the backplane for 2.5-inch hard disk drives or to the mini-SAS signal cable connector on the backplane for 3.5-inch hard disk drives. The backplane for 3.5-inch hard disk drives is installed on the upper hard-disk-drive cage.

Note: The location of the external connector on the RAID card differs depending on the type of RAID card.

To connect the power cables, do the following:

- For server models with up to four 3.5-inch hot-swap hard disk drives, connect the 4-pin power connector on one end of the power cable to the 4-pin power connector on the system board. Then, connect the other power connector on the other end of the power cable to the power connector on the backplane.
- For server models with more than four 3.5-inch hot-swap hard disk drives, use two power cables. Connect the 4-pin power connector on one end of one power cable to the 4-pin power connector on the system board. Then, connect the other power connector on the other end of the power cable to the power connector on the backplane installed on the upper hard-disk-drive cage. Connect the 8-pin power connector on one end of the other power cable to the 8-pin power connector on the power conversion board. Then, connect the other power connector on the other end of the power cable to the power connector on the backplane installed on the lower hard-disk-drive cage.
- For server models with up to eight 2.5-inch hot-swap hard disk drives, connect the 8-pin power connector on one end of the power cable to the 8-pin power connector on the power conversion board. Then, connect the other power connector on the other end of the power cable to the power connector on the backplane.

Refer to the following topics for information about the connector locations:

- “Hot-swap hard-disk-drive backplane” on page 32
- “RAID card” on page 30
- “System board components” on page 39

Connecting the SATA signal cables from the system board to the non-hot-swap hard disk drives

For server models with up to four 3.5-inch non-hot-swap hard disk drives, connect one end of a SATA signal cable to the rear of a non-hot-swap hard disk drive. Then, connect the other end of the SATA signal cable to the appropriate SATA connector on the system board. You also need to connect the appropriate power connector to the rear of the non-hot-swap hard disk drive.

The following table provides information about the recommended SATA connector on the system board for the non-hot-swap hard disk drive installed in each drive bay.

Non-hot-swap hard disk drive	SATA connector on the system board
Installed in bay 0	SATA connector 0
Installed in bay 1	SATA connector 1
Installed in bay 2	SATA connector 2
Installed in bay 3	SATA connector 3

To connect the power cable from the system board to the non-hot-swap hard disk drives, connect the 4-pin power connector on one end of the power cable to the 4-pin power connector on the system board. Then, connect the power connectors on the other end of the power cable to the corresponding power connectors on the hard disk drives.

For more information about the location of the hard-disk-drive bays, power connectors, and SATA connectors on the system board, see “Server components” on page 23 and “System board components” on page 39

System board components

The following illustration shows the component locations on the system board.

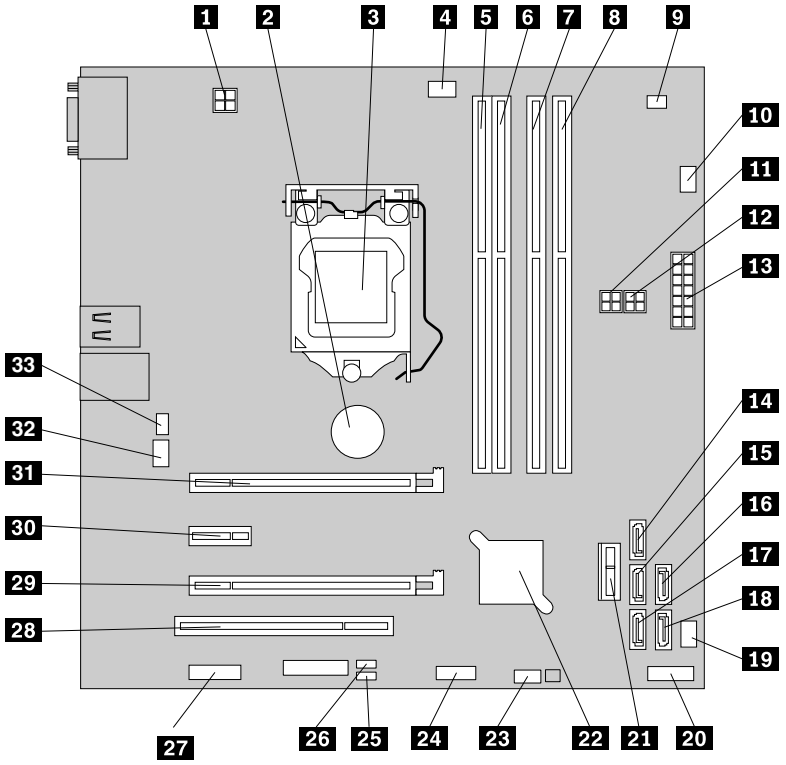


Figure 25. System board components

1 4-pin power connector	18 SATA connector 2
2 System board battery	19 System fan 1 connector
3 Microprocessor socket	20 Front panel connector
4 Microprocessor fan connector	21 Front USB 3.0 connector
5 Memory slot 1 (DIMM1)	22 Platform Controller Hub (PCH)
6 Memory slot 2 (DIMM2)	23 SATA SGPIO connector
7 Memory slot 3 (DIMM3)	24 USB 2.0 connector
8 Memory slot 4 (DIMM4)	25 Clear CMOS (Complementary Metal Oxide Semiconductor) jumper
9 Thermal sensor connector	26 Management Engine (ME) disable jumper
10 System fan 2 connector	27 Serial connector
11 4-pin power connector	28 PCI card slot (PCI slot 4)
12 4-pin power connector	29 PCI Express x4 card slot (PCI-E slot 3)
13 Main power connector	30 PCI Express x1 card slot (PCI-E slot 2)
14 SATA connector 3	31 PCI Express x16 card slot (PCI-E slot 1)
15 SATA connector 0	32 Rear system fan connector
16 SATA connector 4	33 Cover presence switch connector (intrusion switch connector)
17 SATA connector 1	

1 4-pin power connector

Used to connect the power cable from the power supply.

2 System board battery

Your server has a special type of memory that maintains the date, time, and configuration information for built-in features. The system board battery keeps the information active when you turn off the server.

3 Microprocessor socket

The microprocessor is secured in the microprocessor socket on the system board. A heat sink and fan assembly is installed above the microprocessor to provide cooling.

4 Microprocessor fan connector

Used to connect the cable of the heat sink and fan assembly.

5 - 8 Memory slots

Your server system board provides four memory slots to support up to four memory modules. For more information, see “Memory module installation rules” on page 74.

9 Thermal sensor connector

Used to connect the thermal sensor cable.

10 System fan 2 connector

Used to connect the cable of the upper front system fan (front system fan 2).

11 4-pin power connector

Used to connect the power cable for optical drives.

12 4-pin power connector

Used to connect the power cable for hard disk drives.

13 Main power connector

Used to connect the 14-pin power connector of the power supply to provide main power to your server.

14 15 16 17 18 SATA connectors

Used to connect SATA signal cables for the SATA hard disk drives or SATA optical drives.

Notes:

- If your server has one SATA optical drive installed, use a SATA signal cable to connect the optical drive to the SATA connector 4 on the system board.
- If your server has two SATA optical drives installed, use two SATA signal cables to connect the optical drives to the SATA connector 4 and SATA connector 3 on the system board respectively.

19 System fan 1 connector

Used to connect the cable of the lower front system fan (front system fan 1).

20 Front panel connector

Used to connect the front panel cable.

21 Front USB 3.0 connector

Used to connect the front USB cable.

22 Platform Controller Hub (PCH)

This chip provides the data buffering and interface arbitration required to ensure that system interfaces operate efficiently and provides the bandwidth necessary for the system to achieve peak performance.

23 SATA SGPIO connector

Used to connect the SGPIO connector of the mini-SAS signal cable with four SATA connectors and one SGPIO connector to enable the RAID status LEDs for hot-swap hard disk drives.

24 Internal USB 2.0 connector

Reserved for the manufacturer.

25 Clear CMOS (Complementary Metal Oxide Semiconductor) jumper

Used to clear CMOS and turn the BIOS settings into the factory default settings.

Note: Clearing CMOS does not erase your BIOS passwords.

A jumper is a short length of conductor used to set up or adjust a printed circuit board, such as the system board of a computer. A jumper usually is encased in a non-conductive block of plastic for convenient use and to avoid any possible damage to a live circuit. Jumper pins arranged in groups on the system board are called jumper blocks. When two or more jumper pins are capped with a jumper, an electrical connection is made between them and the equipment is thus instructed to activate certain settings accordingly.

To clear CMOS, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Locate the Clear CMOS jumper on the system board.
5. Move the Clear CMOS jumper from the default normal position (pin 1 and pin 2) to the short-circuited position (pin 2 and pin 3).
6. Reconnect the server to an ac power source and turn on the server. Then, wait more than 10 seconds.
7. When you hear beeps, turn off the server. Then, move the Clear CMOS jumper back to the normal position (pin 1 and pin 2).
8. Reinstall the server cover and connect the power cords. See “Completing the parts replacement” on page 163.
9. Connect the server to an ac power source and turn on the server. The clearing CMOS process is completed.

26 Management Engine (ME) disable jumper

Use this jumper to disable the ME.

To disable the ME, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Locate the ME disable jumper on the system board, and then ensure that the jumper is encased in a non-conductive block of plastic.
5. Reinstall the server cover and connect the power cords. See “Completing the parts replacement” on page 163.
6. Connect the server to an ac power source. Then, turn on the server. The ME has been disabled.

27 Serial connector

Used to provide an optional serial connector solution with a required cable.

28 PCI card slot (PCI slot 4)

Used to install a standard 32-bit 33-MHz PCI card with 167 mm (6.57 inches) in length.

29 PCI Express x4 card slot (PCI-E slot 3)

This PCI card slot supports a PCI Express x4 card with 167 mm (6.57 inches) in length, such as an Ethernet card.

30 PCI Express x1 card slot (PCI-E slot 2)

This PCI card slot supports a PCI Express x1 card with 167 mm (6.57 inches) in length, such as a graphics card.

31 PCI Express x16 card slot (PCI-E slot 1)

This PCI card slot supports a PCI Express x16 card with 167 mm (6.57 inches) in length, such as an Ethernet card, a HBA, or a RAID card.

32 Rear system fan connector

Used to connect the cable of the rear system fan.

33 Cover presence switch connector (intrusion switch connector)

Used to connect the cable of the cover presence switch.

Chapter 4. Turning on and turning off the server

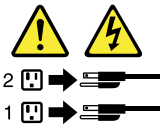
This chapter provides information about turning on and turning off the server.

Turning on the server

After you finish unpacking and setting up the server, connect it to an ac power source. Press the power button on the front panel to turn on the server. See “Front panel” on page 16.

Turning off the server

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



The server can be turned off in one of the following ways:

- Turn off the server from the operating system if your operating system supports this feature. After an orderly shutdown of the operating system, the server will turn off automatically. For instructions on how to shut down your specific operating system, refer to the related documentation or help system for the operating system.
- Press the power button on the front panel to start an orderly shutdown of the operating system and turn off the server, if your operating system supports this feature.
- If your server stops responding and you cannot turn it off, press and hold the power button on the front panel for four seconds or more. If you still cannot turn off the server, disconnect all power cords from the server.
- The server might be turned off as an automatic response to a critical system failure.

Note: For information about your specific operating system, refer to the related documentation or help system for the operating system.

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Chapter 5. Configuring the server

This chapter provides the following information to help you configure the server:

- “Using the Setup Utility program” on page 47
- “Using the ThinkServer EasyStartup program” on page 54
- “Configuring RAID” on page 57
- “Configuring the Ethernet controllers” on page 62
- “Updating the firmware” on page 62

Using the Setup Utility program

This topic provides information about using the Setup Utility program.

The Setup Utility program is part of the server firmware. You can use the Setup Utility program to view and change the configuration settings of your server, regardless of which operating system you are using. However, the operating system settings might override any similar settings in the Setup Utility program.

Starting the Setup Utility program

This topic provides instructions on how to start the Setup Utility program.

To start the Setup Utility program, do the following:

1. Connect the server to an ac power source and press the power button on the front panel to turn on the server. See “Turning on the server” on page 45.
2. Press the F1 key as soon as you see the logo screen. Then, wait for several seconds, and the Setup Utility program opens. If you have set a password, you need to type the correct password to enter the Setup Utility program. For password information, see “Using passwords” on page 51.

Viewing information in the Setup Utility program

The Setup Utility program menu lists various items about the system configuration. Select a desired item to view information or change settings.

When working with the Setup Utility program, you must use the keyboard. The keys used to perform various tasks are displayed on the right bottom pane of each screen. You also can press the F1 key for general help about the keys. For most items, the corresponding help message is displayed on the right top pane of the screen when the item is selected. If the item has submenus, you can display the submenus by pressing Enter.

You can view the following information about your specific server model from the Setup Utility program:

- The **Main** menu lists information about the BIOS version, microprocessor type and core frequency, memory size, installed SATA devices, and system date and time.
- The **Advanced** menu lists information about the installed microprocessor and its supported technologies.

Setup Utility program interface

This topic provides information about the menus and items in the Setup Utility program.

Depending on the version of your system BIOS, some menu or item information might differ slightly from the information in this topic.

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Notes:

- The default settings already are optimized for you. Use the default value for any item you are not familiar with. Do not change the value of unfamiliar items to avoid unexpected problems. If you consider changing the server configuration, proceed with extreme caution. Setting the configuration incorrectly might cause unexpected results. If you cannot turn on the server because of incorrect BIOS settings, use the Clear CMOS jumper to restore the BIOS settings to the factory default settings. See “System board components” on page 39.
- If you have changed any hardware in the server, you might need to reflash the BIOS.

The following menus are listed on the **BIOS Setup Utility** screen:

- **Main**: See “Main menu” on page 48.
- **Devices**: See “Devices menu” on page 48.
- **Advanced**: See “Advanced menu” on page 48.
- **Power**: See “Power menu” on page 49.
- **Security**: See “Security menu” on page 49.
- **Startup**: See “Startup menu” on page 50.
- **Exit**: “Exit menu” on page 50.

Main menu

After entering the Setup Utility program, you can see the **Main** menu, which lists basic information about the BIOS, total memory size, and system date and time.

To set the system date and time on the **Main** menu, see “Setting the system date and time” on page 51.

Devices menu

You can view or change various devices settings on the **Devices** menu in the Setup Utility program. On each submenu, press Enter to view the information or show selectable options and select a desired option by using the up and down arrow keys. Some items are displayed on the menu only if the server supports the corresponding features.

Notes:

- **Enabled** means that the function is configured.
- **Disabled** means that the function is not configured.

The **Devices** menu contains the following submenus. For more information, enter the corresponding submenu and refer to the instructions on the screen.

- **Serial Port Setup**: View and set serial connector configuration parameters.
- **USB Setup**: View and set USB configuration parameters.
- **ATA Drive Setup**: View and set SATA hard-disk-drive configuration parameters.
- **Video Setup**: View and set the primary video adapter type.
- **Network Setup**: Enable or disable the onboard Ethernet controller and other network functions.

Advanced menu

You can view or change various server component settings on the **Advanced** menu in the Setup Utility program. The **Advanced** menu contains various configuration submenus and items. On each submenu, press Enter to show selectable options and select a desired option by using the up and down arrow keys or type desired values from the keyboard. Some items are displayed on the menu only if the server supports the corresponding features.

Notes:

- **Enabled** means that the function is configured.
- **Disabled** means that the function is not configured.

The **Advanced** menu contains the following submenus. For more information, enter the corresponding submenu and refer to the instructions on the screen.

- **CPU Setup**: View and set CPU configuration parameters.
- **Intel® Manageability**: View and set Intel vPRO features.

Power menu

You can view or change various server power management settings on the **Power** menu in the Setup Utility program. The **Power** menu contains various configuration submenus and items. For each submenu and item, press Enter to show selectable options and select a desired option by using the up and down arrow keys or type desired values from the keyboard. Some items are displayed on the menu only if the server supports the corresponding features.

The **Power** menu contains the following items:

- **After Power Loss**: View and configure the system performance after ac power source is removed and restored.
- **Enhanced Power Saving Mode**: Enable or disable Enhanced Power Saving Mode.

The **Power** menu contains the following submenus:

- **Intelligent Cooling Engine (ICE)**: Enable the system to enter the lower acoustic level or better thermal level.
- **Automatic Power On**: Enable or disable the Automatic Power On function.

Security menu

You can set passwords and configure the TPM function on the **Security** menu in the Setup Utility program. For each menu item, press Enter to show selectable options and select a desired option by using the up and down arrow keys or type desired values from the keyboard. Some items are displayed on the menu only if the server supports the corresponding features.

Notes:

- **Enabled** means that the function is configured.
- **Disabled** means that the function is not configured.

The **Security** menu contains the following main items:

- **Administrator Password**: View the status of an administrator password.
- **Power-On Password**: View the status of a user password.
- **Set Administrator Password**: Set an administrator password to protect against unauthorized access to your server. See “Using passwords” on page 51.
- **Set Power-On Password**: Set a user password to protect against unauthorized access to your server. See “Using passwords” on page 51.

The **Security** menu contains the following submenus:

- **TCG Feature Setup**: Configure the TPM function. See “Configuring the TPM function” on page 52.
- **System Event Log**: View and clear the system event log.

- **Secure Boot**: View and set secure boot configuration parameters.

Startup menu

The **Startup** menu in the Setup Utility program provides an interface to help you view or change the server startup options, including the startup sequence and boot priority for various devices. After the server restarts, changes in the startup options take effect.

The startup sequence specifies the order in which the server checks devices to find a boot record. The server starts from the first boot record that it finds. For example, you can define a startup sequence that checks a disc in the optical drive, then checks the hard disk drive, and then checks a network device. For information about setting the startup sequence or selecting a startup device, see "Selecting a startup device" on page 52.

The **Startup** menu contains various configuration submenus and items. For each submenu and item, press **Enter** to show selectable options and select a desired option by using the up and down arrow keys or type desired values from the keyboard. Some items are displayed on the menu only if the server supports the corresponding features.

The **Startup** menu contains the following submenus:

- **Primary Boot Sequence**: This sequence is used when the system is powered up normally.
- **Automatic Boot Sequence**: This sequence is used when a communication device wakes up the system.
- **Error Boot Sequence**: This sequence is used when an error occurs.

The **Startup** menu contains the following items:

- **CSM**: If you select **Enabled**, you can install a non-UEFI operating system. If you select **Disabled**, you can install a UEFI operating system.
- **Boot Mode**: Choose the boot policy.
- **Boot Priority**: Set the boot priority of operating systems.
- **Options Keys Display**: If you select **Enabled**, the option keys will be displayed on the logo screen. If you select **Disabled**, the option keys will not be displayed on the logo screen.
- **Options Keys Display Style**: This item controls the option keys display style when you select **Enabled** for the **Option Keys Display** item.
  - If you select **Legacy**, the message "Press F1 to enter Setup, F12 to display Boot Menu" will be displayed on the logo screen.
  - If you select **Normal**, the message "To interrupt normal startup, press Enter" will be displayed on the logo screen.

Exit menu

After you finish viewing or changing settings in the Setup Utility program, you can choose a desired action from the **Exit** menu to save changes, discard changes, or load default values, and exit the program. Press Enter to select the item on the **Exit** menu, and then select **Yes** when prompted to confirm the action. For information about exiting the Setup Utility program, see "Exiting the Setup Utility program" on page 53.

The **Exit** menu contains the following items:

- **Save Changes and Exit**: Save changes and exit the Setup Utility program.
- **Discard Changes and Exit**: Discard changes, load previous values, and then exit the Setup Utility program.
- **Load Optimal Defaults**: Restore the user default values for all the items.
- **OS Optimized Defaults**: Select **Enabled** to meet the Microsoft Windows 8 certification requirement. The settings for the CSM support, boot mode, boot priority, secure boot, and security RollBack prevention will be affected.

Setting the system date and time

This topic provides instructions on how to set the system date and time in the Setup Utility program.

To set the system date and time in the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 47.
2. On the **Main** menu, select **System Time & Date**.
3. Use the Tab key to switch between data elements and type the numbers from the keyboard to set the system date and time.
4. Press F10 to save settings and exit the Setup Utility program.

Using passwords

By using the Setup Utility program, you can set a password to prevent unauthorized access to your server.

You do not have to set a password to use your server. However, using a password improves computing security. If you decide to set a password, read the following topics.

Setup Utility program password types

The following types of passwords are available in the Setup Utility program:

- **Administrator password**

  Setting an administrator password deters unauthorized users from changing configuration settings. If you are responsible for maintaining the configuration settings of several computers, you might want to set an administrator password. When an administrator password is set, you are prompted to type a valid password each time you try to access the Setup Utility program. The Setup Utility program cannot be accessed until a valid password is typed in.

- **Power-On password**

  When a power-on password is set, the server cannot be used until a valid password is typed in.

Note: If both the administrator password and power-on password are set, you can type either password to use the server. However, you must use your administrator password to change any configuration settings.

Password considerations

For security reasons, it is recommended that you use a strong password that cannot be easily compromised.

Notes:

1. The Setup Utility program passwords are not case sensitive.
2. The server supports Setup Utility program passwords that consist of up to 20 characters.

To set a strong password, use the following guidelines:

- Have at least eight characters in length
- Contain at least one alphabetic character and one numeric character
- Not be your name or your user name
- Not be a common word or a common name
- Be significantly different from your previous passwords

Besides the alphabetic characters (a-z) and numeric characters (0-9), the server also supports characters typed using special keys on the keyboard for a password. Refer to the help message on the screen when setting a password to determine the valid special characters.

Setting, changing, or deleting a password

This topic provides instructions on how to set, change, or delete a password in the Setup Utility program.

To set, change, or delete a password in the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 47.
2. On the **Security** menu, select **Set Administrator Password** to set an administrator password or select **Set Power-On Password** to set a user password.
3. See “Password considerations” on page 51. Then, follow the instructions on the screen to set or change a password.
4. If you want to delete a password, type your current password. Press Enter when you are prompted to type a new password. Then, press Enter to confirm the new password. The previous password will be cleared.

   Note: For security reasons, it is recommended that you always set a password for your server.
5. Press F10 to save settings and exit the Setup Utility program.

If you have forgotten the password, you can use the Clear CMOS jumper on the system board to erase the password. See “System board components” on page 39. Then, set a new password for the server.

Configuring the TPM function

The TPM works as a hardware security solution to help you to encrypt data and protect the server.

To enable the TPM function in the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 47.
2. On the **Security** menu, select **TCG Feature Setup**, and then press Enter.
3. Select **TCG Security Features**. Then, set the **TPM Support** to **Active**.
4. Press F10 to save settings and exit the Setup Utility program. The server will restart in order to enable the TPM function.

Selecting a startup device

If your server does not start up from a desired device such as the disc or hard disk drive as expected, do one of the following to select the startup device you want:

Note: Not all discs, hard disk drives, or other removable devices are bootable.

- To select a temporary startup device, do the following:

  Note: Selecting a startup device using the following method does not permanently change the startup sequence.

1. Turn on or restart your server.
2. When you see the logo screen, press F12 to display the boot menu. The boot device selection window opens.
3. In the boot device selection window, use the up and down arrow keys on the keyboard to switch between the selections. Press Enter to select the device of your choice. Then, the server will start up from the selected device.

- To view or permanently change the configured startup device sequence, do the following:
  1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 47.
  2. On the **Startup** menu, follow the instructions on the screen to set the startup device depending on your needs. You also can set the boot priority for various devices. See “Startup menu” on page 50.
  3. Press F10 to save settings and exit the Setup Utility program. The server will follow the startup device sequence you have set each time you turn on the server.

Exiting the Setup Utility program

After you finish viewing or changing settings, press Esc to return to the Setup Utility program main interface. If you are on a nested submenu, press Esc repeatedly until you reach the main interface. Then, you can do one of the following:

- If you want to save the new settings and exit the Setup Utility program, press F10 or select **Exit → Save Changes and Exit**. Otherwise, your changes will not be saved.
- If you do not want to save the new settings, select **Exit → Discard Changes and Exit**.
- If you want to return to the default settings, press F9 or select **Exit → Load Optimal Defaults**.

For more information about the **Exit** menu in the Setup Utility program, see “Exit menu” on page 50.

Updating or recovering the BIOS

This topic provides instructions on how to update the BIOS and how to recover from a POST and BIOS update failure.

System programs are the basic layer of software built into your server. System programs include the POST, the UEFI BIOS, and the Setup Utility program. The POST is a set of tests and procedures that are performed each time you turn on your server. The UEFI BIOS is a layer of software that translates instructions from other layers of software into electrical signals that the server hardware can execute. You can use the Setup Utility program to view or change the configuration settings of your server. See “Using the Setup Utility program” on page 47.

Lenovo might make changes and enhancements to the BIOS. When updates are released, they are available for download on the Lenovo Web site at http://www.lenovo.com/drivers. You can update the server firmware by downloading an update package and following the instructions on the Web page.

You also can use the Firmware Updater program to help you keep the server firmware up-to-date. See “Updating the firmware” on page 62.

Updating (flashing) the BIOS

This topic provides instructions on how to update (flash) the BIOS.

Notes:

- Update the BIOS on your server only if the newer BIOS version specifically solves a problem you have. We do not recommend BIOS updates for servers that do not need them. You can view the updated information for the new BIOS version in the installation instructions for the BIOS update utility program.

- Downgrading the BIOS to an earlier version is not recommended and might not be supported. An earlier BIOS version might not contain the support for the latest system configurations.
- If the power to your server is interrupted while the POST and BIOS are being updated, your server might not restart correctly. Ensure that you perform the BIOS update procedure in an environment with a steady power supply. Besides, ensure that your server can restart successfully without encountering hardware problems.
- If you have updated the BIOS firmware, all the BIOS settings become the default settings of the updated BIOS version. You need to check and reconfigure the BIOS settings for your specific needs.

To update (flash) the BIOS, do the following:

1. Go to http://www.lenovo.com/drivers and follow the instructions on the Web page to locate the BIOS update package.
2. Download the BIOS update package and the TXT file that contains installation instructions.
3. Print the TXT file and follow the instructions to update (flash) the BIOS.
4. Check and reconfigure the BIOS settings for your specific needs based on your note or refer to “Using the Setup Utility program” on page 47 after the BIOS update process is completed.

Using the ThinkServer EasyStartup program

This topic guides you to use the ThinkServer EasyStartup program to set up and configure your server.

The ThinkServer EasyStartup program simplifies the process of configuring RAID and installing supported Windows and Linux operating systems and device drivers on your server. The program works with your Windows or Linux operating system installation disc to automate the process of installing the operating system and associated device drivers. This program is provided with your server on a self-starting (bootable) *ThinkServer EasyStartup* DVD. The user guide for the program is also on the DVD and can be accessed directly from the program interface.

If you do not have a *ThinkServer EasyStartup* DVD, you also can download an ISO image from the Lenovo Support Web site and make a disc by yourself.

To download the ThinkServer EasyStartup program image and burn it into a disc, do the following:

1. Go to http://www.lenovo.com/drivers and follow the instructions on the Web page to locate the ThinkServer EasyStartup program.
2. Download the ISO image for the ThinkServer EasyStartup program and the readme file. The readme file contains important information about the ThinkServer EasyStartup program.
3. Print the readme file and read it carefully.
4. Use an optical drive and any DVD burning software to create a bootable disc with the ISO image.

Features of the ThinkServer EasyStartup program

This topic lists the features of the ThinkServer EasyStartup program.

The ThinkServer EasyStartup program has the following features:

- Contained in a self-starting (bootable) DVD
- Easy-to-use, language-selectable interface
- Integrated help system and user guide
- Automatic hardware detection
- RAID configuration utility

- Device drivers provided based on the server model and detected devices
- Ability to download device drivers from the *ThinkServer EasyStartup* DVD according to the operating system or add-on device
- Selectable partition size and file system type
- Support for multiple operating systems
- Ability to install the operating system and device drivers in an unattended mode to save time
- Ability to create a reusable response file that can be used with similarly configured Lenovo servers to make future installations even faster

Starting the ThinkServer EasyStartup program

This topic provides instructions on how to start the ThinkServer EasyStartup program. After you start the program and enter the main interface, click **User Guide** for detailed information about how to use this program to help you configure the server and install an operating system.

To start the ThinkServer EasyStartup program, do the following:

1. Insert the *ThinkServer EasyStartup* DVD into the optical drive, set the optical drive as the first startup device, and start your server from the DVD in the optical drive. See “Selecting a startup device” on page 52.
2. Wait for the ThinkServer EasyStartup program to load. Then, you will be prompted for the following selections:
   - The language in which you want to view the program
   - The language of the keyboard layout you will be using with the program

   Note: The supported languages and keyboard layouts for the ThinkServer EasyStartup program are German, English, Spanish, French, Italian, Dutch, Turkish, and Japanese. Your *ThinkServer EasyStartup* DVD might be English only. In this case, the keyboard layout should be English.
3. After selecting the language and keyboard layout, click **OK**. Then, you will see one or more messages about configuring storage devices. Click **Next** until you are presented with the Lenovo License Agreement. Read the Lenovo License Agreement carefully. In order to continue, you must agree those terms by clicking **Agree**. Then, the Date and time window opens.
4. Set the current date and time and click **OK**. The Start option window opens.
5. The Start option window provides the following selections:
   - Continue to the main interface.
   - Install the operating system using a pre-existing response file.
   - Configure RAID using a pre-existing response file.

   Read the explanations on the screen and select a desired option. Then, follow the instructions on the screen. If this is the first time you are using the ThinkServer EasyStartup program, select the option to continue to the main interface and view the compatibility notes and user guide.

Notes:

1. Functionality and supported operating systems vary depending on the version of the ThinkServer EasyStartup program. From the main interface of the program, click **Compatibility notes** to view the information about the RAID controllers, operating systems, and server configurations supported by the specific version of the program and click **User Guide** to view the various functions and learn how to use the program.
2. Before using the ThinkServer EasyStartup program to install an operating system, ensure that any external storage devices and fiber channels are configured correctly.

The ThinkServer EasyStartup program main interface provides the following menus on the left pane of the screen:

- **Home**

  This menu is the welcome page that contains some general descriptions about the program and the Lenovo copyright and trademark statements.

- **Compatibility notes**

  This menu provides information about the RAID controllers, operating systems, and server configurations supported by the version of the program you are using.

- **User Guide**

  This menu provides information about the features of the program and instructions on how to use the program.

- **Hardware list**

  This menu displays a list of hardware devices detected by the program.

- **Configure RAID**

  This menu guides you to configure RAID or view the current RAID configuration and make changes if needed.

- **Install operating system**

  This menu displays a series of choices and prompts to collect information required for operating system installation, prepares the hard disk drive for installation, and then initiates the installation process using your operating system installation disc.

- **Download drivers**

  This menu helps you download the required device drivers from the *ThinkServer EasyStartup* DVD to a removable storage device so that you can easily get the drivers for server configuration when you need them.

  Note: The most up-to-date device drivers for various server models are always available for download on the Lenovo Support Web site at:
  http://www.lenovo.com/drivers

- **About**

  This menu provides the version information and legal notices.

Using the ThinkServer EasyStartup program on a Windows operating system

You can run the *ThinkServer EasyStartup* DVD on a Windows operating system with the Internet Explorer® 6.0 Web browser or a later version installed. Enter the operating system and insert the *ThinkServer EasyStartup* DVD into an internal or external optical drive. The DVD starts automatically in most environments. If the DVD fails to start, open the launch.exe file located in the root directory of the DVD.

Notes:

- You should read and accept the Lenovo License Agreement when prompted.
- On the Microsoft Windows Server® 2003 and Windows Server 2012 operating systems, you might need to add the Uniform Resource Locator (URL) for the ThinkServer EasyStartup program Web page to the trusted Web site list so that the page can open correctly.

You can do the following when using the ThinkServer EasyStartup program on a Windows operating system. For detailed information, refer to the help system.

- View a general introduction to your ThinkServer server model and the specific server configuration information.
- View general guidance on how to use the *ThinkServer EasyStartup* DVD.
- Download the required device drivers to a removable storage device so that you can easily get the drivers for server configuration when you need them, especially when you finish installing an operating system without using the *ThinkServer EasyStartup* DVD and need appropriate device drivers to configure your server.
- Install the required device drivers directly on the server on which you are running the *ThinkServer EasyStartup* DVD.
- View information about all server models supported by the ThinkServer EasyStartup program and information about the device drivers for each server model, including the driver versions and driver locations in the root directory of the *ThinkServer EasyStartup* DVD.

  Note: The most up-to-date device drivers for various server models are always available for download on the Lenovo Support Web site at:
  http://www.lenovo.com/drivers

Configuring RAID

This topic provides information about RAID and the utility programs that are available for you to configure RAID.

This topic contains the following items:

- "About RAID" on page 57
- "RAID for your server" on page 58
- "Configuring the system BIOS to enable onboard SATA RAID functionality" on page 59
- "Configuring the advanced SATA or SAS hardware RAID" on page 61

About RAID

RAID, an acronym for Redundant Array of Independent Disks, is a technology that provides increased storage functions and reliability through redundancy. This is achieved by combining multiple hard disk drives into a logical unit, where data is distributed across the drives in one of several ways called RAID levels.

When a group of independent physical hard disk drives are set up to use RAID technology, they are in a RAID array. This array distributes data across multiple hard disk drives, but the array appears to the host server as one single storage unit. Creating and using RAID arrays provides high performance, such as the expedited I/O performance, because several drives can be accessed simultaneously.

RAID drive groups also improve data storage reliability and fault tolerance compared to single-drive storage systems. Data loss resulting from a drive failure can be prevented by reconstructing missing data from the remaining drives.

The following list describes some of the most commonly used RAID levels:

- **RAID 0**: block-level striping without parity or mirroring

  Simple stripe sets are normally referred to as RAID 0. RAID 0 uses striping to provide high data throughput, especially for large files in an environment that does not require fault tolerance. RAID 0 has no redundancy and it provides improved performance and additional storage without fault tolerance. Any drive failure destroys the array and the likelihood of failure increases with more drives in the array. RAID 0 does not implement error checking, so any error is uncorrectable. More drives in the array means higher bandwidth, but greater risk of data loss.

  RAID 0 requires a minimum number of two hard disk drives.

- **RAID 1**: mirroring without parity or striping

  RAID 1 uses mirroring so that data written to one drive is simultaneously written to another drive. This is good for small databases or other applications that require small capacity but complete data redundancy. RAID 1 provides fault tolerance from disk errors or failures and continues to operate as long as at least one drive in the mirrored set is functioning. With appropriate operating system support, there can be increased read performance and only a minimal write performance reduction.

  RAID 1 requires a minimum number of two hard disk drives.

- **RAID 5**: block-level striping with distributed parity

  RAID 5 uses disk striping and parity data across all drives (distributed parity) to provide high data throughput, especially for small random access. RAID 5 distributes parity along with the data and requires all drives but one to be present to operate; drive failure requires replacement, but the array is not destroyed by a single drive failure. Upon drive failure, any subsequent read operations can be calculated from the distributed parity so that the drive failure is masked from the end user. The array will have data loss in the event of a second drive failure and is vulnerable until the data that was on the failing drive is rebuilt onto a replacement drive. A single drive failure in the set will result in reduced performance of the entire set until the failing drive has been replaced and rebuilt.

  RAID 5 requires a minimum number of three hard disk drives.

- **RAID 10**: a combination of RAID 0 and RAID 1

  RAID 10 consists of striped data across mirrored spans. A RAID 10 drive group is a spanned drive group that creates a striped set from a series of mirrored drives. RAID 10 allows a maximum of eight spans. You must use an even number of drives in each RAID virtual drive in the span. The RAID 1 virtual drives must have the same stripe size. RAID 10 provides high data throughput and complete data redundancy but uses a larger number of spans.

  RAID 10 requires a minimum number of four hard disk drives and also requires an even number of drives, for example, six hard disk drives or eight hard disk drives.

- **RAID 50**: a combination of RAID 0 and RAID 5

  RAID 50 uses distributed parity and disk striping. A RAID 50 drive group is a spanned drive group in which data is striped across multiple RAID 5 drive groups. RAID 50 works best with data that requires high reliability, high request rates, high data transfers, and medium-to-large capacity.

  Note: Having virtual drives of different RAID levels, such as RAID 0 and RAID 5, in the same drive group is not allowed. For example, if an existing RAID 5 virtual drive is created out of partial space in an array, the next virtual drive in the array has to be RAID 5 only.

  RAID 50 requires a minimum number of six hard disk drives.

For detailed information about RAID, refer to “Introduction to RAID” in the *MegaRAID SAS Software User Guide* on the documentation DVD that comes with your server.

RAID for your server

This topic provides information about the RAID supported by your server.

Note: Before configuring RAID for your server, ensure that you use hard disk drives that are of the same type (SATA or SAS) and have the same capacity within a single RAID array.

Your server supports the following two types of RAID configurations:

- **Onboard SATA software RAID configuration using the Intel Rapid Storage Technology enterprise program**

  The onboard SATA software RAID controller is integrated on the Intel C220 chip on the system board. If your server has SATA hard disk drives that are connected to the system board, you can use the Intel Rapid Storage Technology enterprise program to configure RAID. By default, your server supports onboard SATA software RAID levels 0, 1, 5, and 10.

  For detailed information, see "Configuring the system BIOS to enable onboard SATA RAID functionality" on page 59.

- **Advanced SATA/SAS hardware RAID configuration using the WebBIOS Configuration Utility program; and RAID management using the MegaRAID Storage Manager program and the MegaCLI Configuration Utility program (requires a RAID card)**

  Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. You also can purchase the RAID card from Lenovo and install it into server models that support the RAID card to get advanced SATA/SAS hardware RAID functions. See "RAID card" on page 30 and "Installing or removing the RAID card" on page 82 for more information.

  Note: For server models with more than four hard disk drives or models that use SAS hard disk drives, a RAID card must be installed.

  The RAID card provides the WebBIOS Configuration Utility program to help you configure RAID independently of the operating system. You also can install the MegaRAID Storage Manager program and the MegaCLI Configuration Utility program to help you manage the RAID array and RAID controller in an operating system environment. The supported RAID levels are RAID 0, 1, and 10 by default. For the ThinkServer RAID 500 Adapter, to activate RAID 5 and RAID 50 levels, you need to install a RAID 5 key on the RAID card. See "Installing or removing the ThinkServer RAID 500 Upgrade Key for Advanced RAID" on page 84.

  For detailed information, see "Configuring the advanced SATA or SAS hardware RAID" on page 61.

Note: The ThinkServer EasyStartup program simplifies the process of configuring supported RAID and installing supported operating systems and device drivers.

Before configuring RAID for your server, observe the following precautions:

1. Use hard disk drives that have the same capacity within a single RAID array.
2. Use hard disk drives that are of the same type (SATA or SAS) within a single RAID array.
3. Depending on the operating system, the primary RAID might be limited to 2 TB total drive capacity.

Configuring the system BIOS to enable onboard SATA RAID functionality

This section describes how to configure the system BIOS to enable onboard SATA RAID functionality.

Note: Use the arrow keys on the keyboard to make selections.

To enable SATA RAID functionality, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 47.
2. Select **Devices → ATA Drive Setup**.
3. Select **Configure SATA as** and press Enter.
4. Select **RAID Mode** and press Enter.
5. Press F10 to save changes and exit the Setup Utility program.

Creating RAID volumes

This section describes how to use the Intel Rapid Storage Technology enterprise option ROM configuration utility to create RAID volumes.

To create RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.
2. Use the up and down arrow keys to select **Create RAID Volume** and press Enter.
3. Type a proper RAID volume name in the **Name** field and press Tab.
4. Use the arrow keys to select a RAID level in the **RAID Level** field and press Tab.
5. If appropriate, use the arrow keys to select a stripe size in the **Stripe Size** field and press Tab.
6. Type a volume size in the **Capacity** field and press Tab.
7. Press Enter to initiate volume creation.
8. When prompted, press Y to accept the warning message and create the volume.
9. If desired, return to step 2 to create additional RAID volumes.
10. When finished, select **Exit** and press Enter.

Deleting RAID volumes

This section describes how to use the Intel Rapid Storage Technology enterprise option ROM configuration utility to delete RAID volumes.

To delete RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.
2. Use the up and down arrow keys to select **Delete RAID Volume** and press Enter.
3. Use the arrow keys to select the RAID volume to be deleted and press Delete.
4. When prompted, press Y to confirm the deletion of the selected RAID volume. Deleting a RAID volume will reset the hard disk drives to non-RAID.
5. After deleting a RAID volume, you can:
   - Return to step 2 to delete additional RAID volumes.
   - See “Creating RAID volumes” on page 60 for RAID volume creation.
   - Use the up and down arrow keys to select **Exit** and press Enter.

Resetting disks to non-RAID

This section describes how to reset your hard disk drives to non-RAID.

To reset your hard disk drives to non-RAID, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.
2. Use the up and down arrow keys to select **Reset Disks to Non-RAID** and press Enter.
3. Use the arrow keys and the space key to mark individual physical hard disk drives to be reset, and then press Enter to complete the selection.
4. When prompted, press Y to confirm the reset action.
5. After resetting the hard disk drives to non-RAID, you can:
   - See “Deleting RAID volumes” on page 60 for RAID volume deletion.
   - See “Creating RAID volumes” on page 60 for RAID volume creation.
   - Use the up and down arrow keys to select **Exit** and press Enter.

Configuring the advanced SATA or SAS hardware RAID

Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. You also can purchase the RAID card from Lenovo and install it into server models that support the RAID card to get advanced SATA/SAS hardware RAID functions. See “RAID card” on page 30 and “Installing or removing the RAID card” on page 82 for more information.

Note: For server models with more than four hard disk drives or models that use SAS hard disk drives, a RAID card must be installed.

The RAID card provides the WebBIOS Configuration Utility program to help you configure RAID independently of the operating system. You also can install the MegaRAID Storage Manager program and the MegaCLI Configuration Utility program to help you manage the RAID array and RAID controller in an operating system environment. The supported RAID levels are RAID 0, 1, and 10 by default. For the ThinkServer RAID 500 Adapter, to activate RAID 5 and 50 levels, you need to install a RAID 5 key on the RAID card. See “Installing or removing the ThinkServer RAID 500 Upgrade Key for Advanced RAID” on page 84.

The installation packages for the MegaRAID Storage Manager program and the MegaCLI Configuration Utility program are on the *ThinkServer EasyStartup* DVD. After you enter the operating system, insert the *ThinkServer EasyStartup* DVD into the optical drive. The installation packages for the programs are located in the Utilities and Others folder in the root directory of the DVD.

Note: The *ThinkServer EasyStartup* DVD is designed for different types of servers and the Utilities and Others folder might contain additional installation packages that are not required to be installed into your server.

For instructions on how to configure and manage the advanced SATA or SAS hardware RAID, refer to the *MegaRAID SAS Software User Guide* on the documentation DVD that comes with your server. This document is also available on the Lenovo Web site at:
http://www.lenovo.com/UserManuals

Configuring RAID using the ThinkServer EasyStartup program

The ThinkServer EasyStartup program simplifies the process of configuring supported RAID and installing supported Windows and Linux operating systems and device drivers on your server. The user guide for the program can be accessed directly from the program interface.

The ThinkServer EasyStartup program has the following features for RAID configuration:

- For use with all supported RAID controllers
- Automatically detects hardware and lists all supported RAID configurations
- Configures one or more disk arrays per controller depending on the number of drives attached to the controller and the RAID level selected
- Supports hot-spare drives
- Creates a RAID response file that can be used to configure RAID controllers on similarly configured Lenovo servers

See “Using the ThinkServer EasyStartup program” on page 54 and view the user guide from the main interface of the program.

Some RAID management software also is provided on the *ThinkServer EasyStartup* DVD to help you manage RAID arrays and RAID controllers in an operating system environment. After you enter the operating system, insert the *ThinkServer EasyStartup* DVD into the optical drive. The installation packages for the programs are located in the Utilities and Others folder in the root directory of the DVD. The *ThinkServer EasyStartup* DVD is designed for different types of servers and the Utilities and Others folder might contain additional installation packages that are not required to be installed into your server. For more information, see “Installing and

using the MegaRAID Storage Manager program" on page 62 and "Configuring the advanced SATA or SAS hardware RAID" on page 61.

Installing and using the MegaRAID Storage Manager program

You can install and use the MegaRAID Storage Manager program to manage the RAID array and RAID controller in an operating system environment after configuring RAID.

The installation package for the MegaRAID Storage Manager program is on the *ThinkServer EasyStartup* DVD. After you enter the operating system, insert the *ThinkServer EasyStartup* DVD into the optical drive. The installation package for the MegaRAID Storage Manager program is located in the Utilities and Others folder in the root directory of the DVD.

To install and use the MegaRAID Storage Manager program, refer to the following chapters in the *MegaRAID SAS Software User Guide* on the documentation DVD that comes with your server:

Note: Some information in these chapters might be intended for the advanced SATA/SAS hardware RAID configurations and might not apply to the onboard SATA software configurations.

- "MegaRAID Storage Manager Overview and Installation"
- "MegaRAID Storage Manager Window and Menus"
- "Monitoring System Events and Storage Devices"
- "Maintaining and Managing Storage Configurations"

The *MegaRAID SAS Software User Guide* also is available on the Lenovo Web site at:
http://www.lenovo.com/UserManuals

Configuring the Ethernet controllers

The Ethernet controllers are integrated on the system board. They provide an interface for connecting to a 10 Mbps, 100 Mbps, or 1000 Mbps network and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the network.

You do not have to set any jumpers or configure the Ethernet controllers. However, you must install a device driver to enable the operating system to recognize the controllers.

The ThinkServer EasyStartup program simplifies the process of configuring RAID and installing supported operating systems and device drivers on your server. See "Using the ThinkServer EasyStartup program" on page 54.

The device drivers for onboard Ethernet controllers are also available for download at:
http://www.lenovo.com/drivers

Updating the firmware

The firmware in the server is periodically updated and is available for download on the Lenovo Web site.

Go to http://www.lenovo.com/drivers and follow the instructions on the Web page to check for the latest level of firmware, such as the BIOS updates and device drivers.

When you replace a device in the server, you might have to either update the server with the latest version of the firmware that is stored in memory on the device or reflash the BIOS and the FRU/SDR.

Using the Firmware Updater program

The Firmware Updater program enables you to maintain your system firmware up-to-date and helps you avoid unnecessary outages.

To update your system firmware using the Firmware Updater program, do the following:

Note: Before distributing the firmware updates to a server, ensure that your server can restart successfully without encountering hardware problems.

1. Go to http://www.lenovo.com/drivers and follow the instructions on the Web page to locate the Firmware Updater program.
2. Download the ISO image for the Firmware Updater program and the TXT file that contains the installation instructions.
3. Use any CD or DVD burning software to create a bootable disc with the ISO image.
4. Print the TXT file and follow the instructions to use the Firmware Updater program to update your system firmware.

Chapter 6. Installing, removing, or replacing hardware

This chapter provides instructions on how to install, remove, or replace hardware for your server.

This chapter contains the following items:

- "Guidelines" on page 65
- "Removing the server cover" on page 67
- "Removing and reinstalling the front bezel" on page 69
- "Removing and reinstalling the PCI card bracket assembly" on page 71
- "Installing, removing, or replacing hardware" on page 74
- "Completing the parts replacement" on page 163

For a list of ThinkServer options, go to:
http://www.lenovo.com/thinkserver

Guidelines

This topic provides some guidelines that you should read and understand before using your server.

Precautions

Before you use the server, be sure to read and understand the following precautions:

- Before using the product, be sure to read and understand the multilingual safety instructions and the Lenovo Limited Warranty (LLW) on the documentation DVD that comes with the product. Reading and understanding the safety instructions reduces the risk of personal injury and damage to your product.
- When you install your new server, take the opportunity to download and apply the most recent firmware updates. This step will help to ensure that any known issues are addressed and that your server is ready to function at maximum levels of performance. To download firmware updates for your server, go to http://www.lenovo.com/drivers, and then follow the instructions on the Web page. See "Updating the firmware" on page 62 for more information.
- Before you install optional hardware devices, ensure that the server is working correctly. If the server is not working correctly, see Chapter 7 "Troubleshooting and diagnostics" on page 167 to do basic troubleshooting. If the problem cannot be solved, see Chapter 8 "Getting information, help, and service" on page 173.
- Observe good housekeeping in the area where you are working. Put removed covers and other parts in a safe place.
- If you must turn on the server while the server cover is removed, ensure that no one is near the server and that no tools or other objects have been left inside the server.
- Do not attempt to lift an object that you think is too heavy for you. If you have to lift a heavy object, observe the following precautions:
  - Ensure that you can stand safely without slipping.
  - Distribute the weight of the object equally between your feet.
  - Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
  - To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Ensure that you have enough properly grounded electrical outlets for the server, monitor, and other devices.

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- Back up all important data before you make changes to drives.
- Have a small flat-blade screwdriver available.
- You do not have to turn off the server to install or replace a hot-swap redundant power supply, hot-swap hard disk drives, or hot-plug USB devices. However, you must turn off the server before performing any steps that involve installing, removing, or replacing adapter cables or non-hot-swap devices or components.
- To view the LEDs on the system board and internal components, leave the server connected to power.
- When you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.
- When working inside the server, you might find some tasks easier if you lay the server on its side.

Handling static-sensitive devices

Attention: Do not open the static-protective package that contains the new part until the defective part has been removed from the server and you are ready to install the new part. Static electricity, although harmless to you, can seriously damage server components and parts.

When you handle server parts and components, take these precautions to avoid static-electricity damage:

- Limit your movement. Movement can cause static electricity to build up around you.
- The use of a grounding system is recommended. For example, wear an electrostatic discharge (ESD) wrist strap, if one is available. Ensure that you work in an ESD-safe area.
- Always carefully handle the parts and other components (such as PCI cards, memory modules, system boards, and microprocessors) by its edges or its frame. Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and damage it.
- Before you replace a new part, touch the static-protective package containing the new part to an unpainted metal part of the server for at least two seconds. This reduces static electricity from the package and your body.
- Remove the new part from the static-protective package and directly install it in the server without placing it on any other surface. If it is hard for you to do this in your specific situation, place the static-protective package of the new part on a smooth, level surface, and then place the new part on the static-protective package.
- Do not place the part on the server cover or other metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

System reliability guidelines

To help ensure proper cooling and system reliability, ensure that you follow these guidelines:

- Each of the drive bays has a drive or a dummy tray installed; or there is an electromagnetic interface (EMI) protective panel or EMI shield installed to protect the drive cage.
- If the server has redundant power, each of the power supply bay has a redundant power supply installed, or one bay has a redundant power supply while the other bay is covered by a shield.
- Leave adequate space around the server to ensure that the server cooling system works well. Leave approximately 50 mm (2 inches) of open space around the front and rear of the server. Do not place objects in front of the fans. For proper cooling and airflow, install the server cover before you turn on the server. Operating the server for extended periods of time (more than 30 minutes) with the server cover removed might damage server components.
- Properly route the cables. For some options, such as PCI cards, follow the cabling instructions that come with the options in addition to the instructions in this manual.

- Ensure that you replace a failing fan within 48 hours.
- When replacing a hot-swap drive, install the new hot-swap drive within two minutes of removal.

Working inside the server with the power on

Attention: Static electricity that is released to internal server components when the server is turned on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an ESD wrist strap or other grounding system when you work inside the server with the power on.

The server supports hot-swap devices and is designed to operate safely while it is turned on and the cover is removed. Follow these guidelines when you work inside the server with the power on:

- Avoid wearing loose-fitting clothing on your forearms. Button long-sleeved shirts before working inside the server; do not wear cuff links while you are working inside the server.
- Do not allow your necktie or scarf to hang inside the server.
- Remove jewelry, such as bracelets, necklaces, rings, and loose-fitting wrist watches.
- Remove items from your shirt pocket, such as pens and pencils. These items might fall into the server as you lean over it.
- Avoid dropping any metallic objects into the server, such as paper clips, hairpins, and screws.

Removing the server cover

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to remove the server cover.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To remove the server cover, do the following:

1. Remove all media from the drives. Then, turn off all attached devices and the server.
2. Disconnect all power cords from electrical outlets.
3. Disconnect the power cords, Input/Output (I/O) cables, and all other cables that are connected to the server.
4. Remove any locking device that secures the server cover, such as a padlock or an integrated cable lock. See “Server locks” on page 20.

5. Loosen the thumbscrew that secures the server cover, and then slide the server cover to the rear until it is stopped.

   Notes:

   a. The server cover is securely installed and you need to use a tool, such as a screwdriver, to loosen the thumbscrew that secures the server cover. The thumbscrew is an integrated part of the server cover. Do not try to remove the thumbscrew from the server cover.

   b. It is recommended that you wait three to five minutes to let the server cool before removing the server cover.

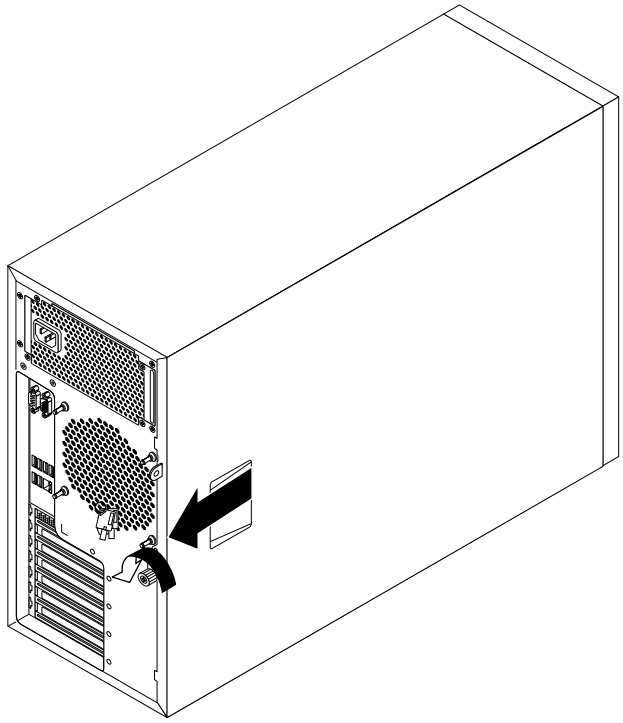


Figure 26. Sliding the server cover to the rear

6. Pivot the server cover outward to remove it.

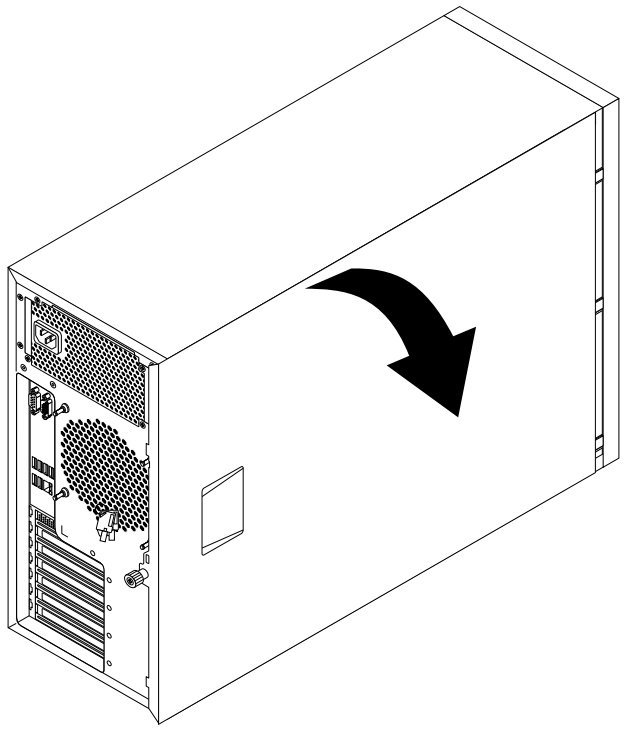


Figure 27. Removing the server cover

Attention: For proper cooling and airflow, install the server cover before turning on the server. Operating the server for more than 30 minutes with the server cover removed might damage server components.

To reinstall the server cover, see “Reinstalling the server cover and reconnecting cables” on page 163.

Removing and reinstalling the front bezel

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to remove and reinstall the front bezel.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To remove and reinstall the front bezel, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.

3. Remove the front bezel by releasing the three plastic tabs on the left side and pivoting the front bezel outward.

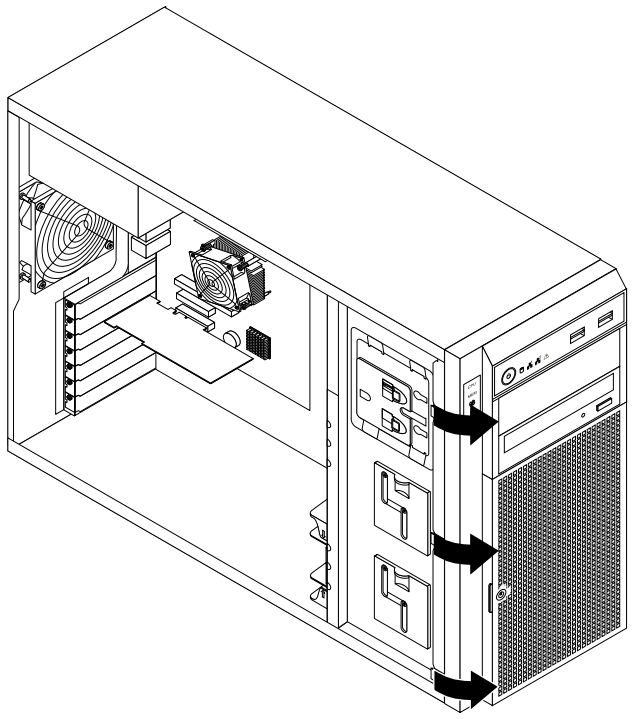


Figure 28. Removing the front bezel

4. To reinstall the front bezel, align the other three plastic tabs on the right side of the front bezel with the corresponding holes in the chassis, then pivot the front bezel inward until it snaps into position on the left side.

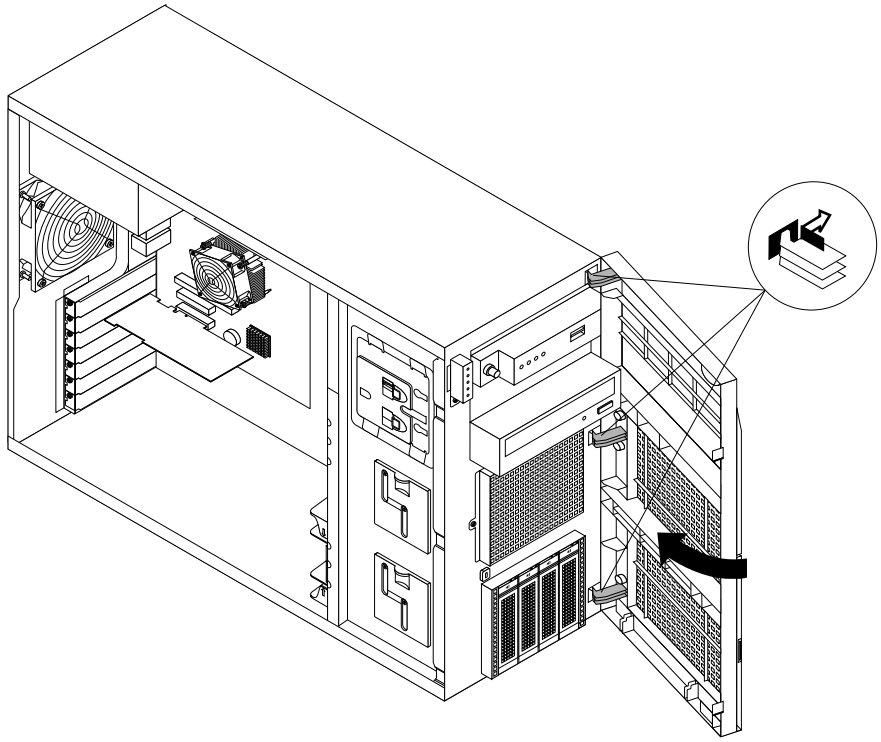


Figure 29. Installing the front bezel

5. Go to “Completing the parts replacement” on page 163.

Removing and reinstalling the PCI card bracket assembly

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to remove and reinstall the PCI card bracket assembly. This topic applies only to server models that have a RAID card installed.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

To remove and reinstall the PCI card bracket assembly, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the PCI card bracket assembly by doing the following:

a. Press the release tab **1** in the direction as shown, and then carefully lift the PCI card bracket assembly slightly upward until each of the two retention posts **2** on the chassis is in the central position of the corresponding hole in the PCI card bracket assembly.

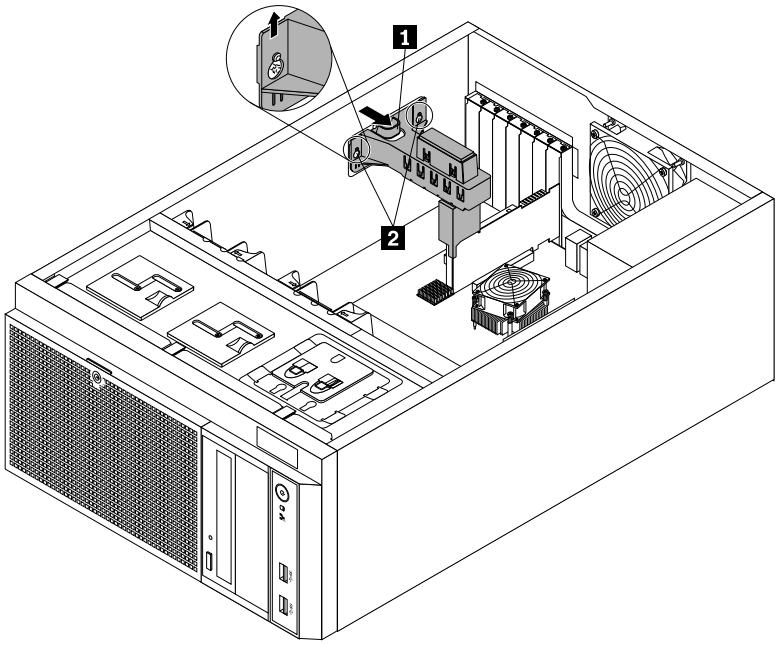


Figure 30. Releasing the PCI card bracket assembly

b. Carefully move the PCI card bracket assembly to the top side of the chassis until the PCI card bracket assembly is released from the retention posts on the chassis. Then, lift the PCI card bracket assembly out of the chassis.

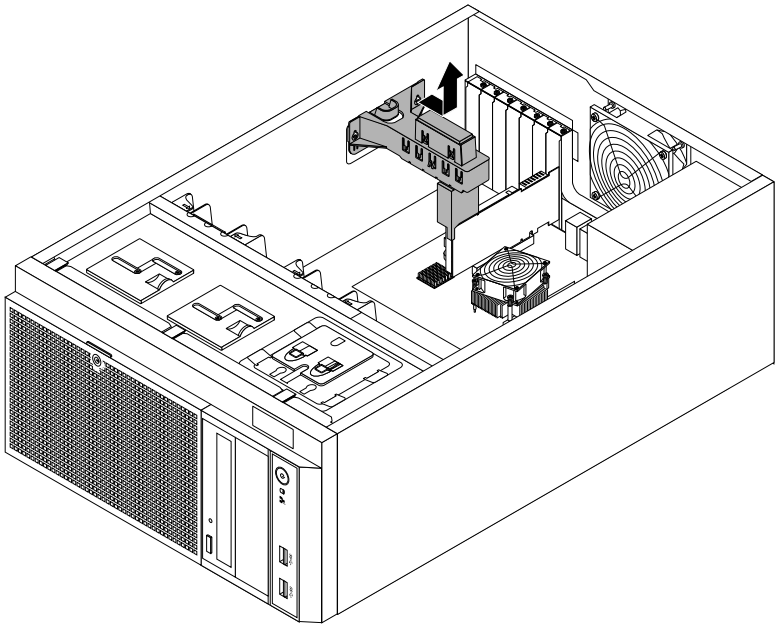


Figure 31. Removing the PCI card bracket assembly

5. Reinstall the PCI card bracket assembly by doing the following:
   a. Install the small low-profile PCI card bracket into the main PCI card bracket as shown.

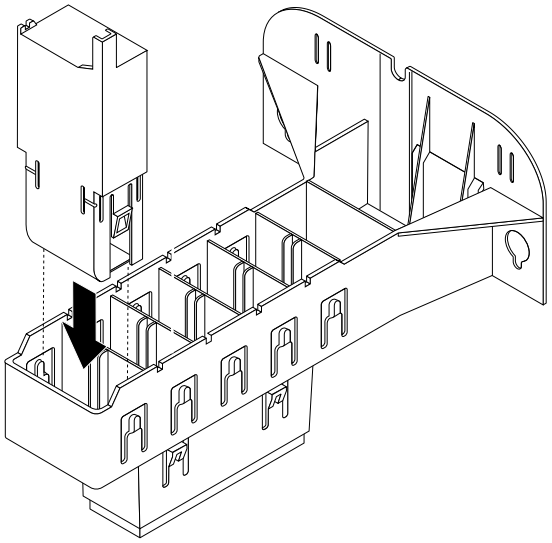


Figure 32. Installing the small low-profile PCI card bracket into the main PCI card bracket

   b. Place the PCI card bracket assembly into the chassis so that the two retention posts **2** on the bottom of the chassis are inserted into the corresponding holes in the PCI card bracket assembly. Ensure that the edge of the RAID card can be smoothly inserted into the slot **1** in the small low-profile PCI card bracket. Then, carefully press the PCI card bracket assembly down until it is securely installed and locked into position by the two retention posts.

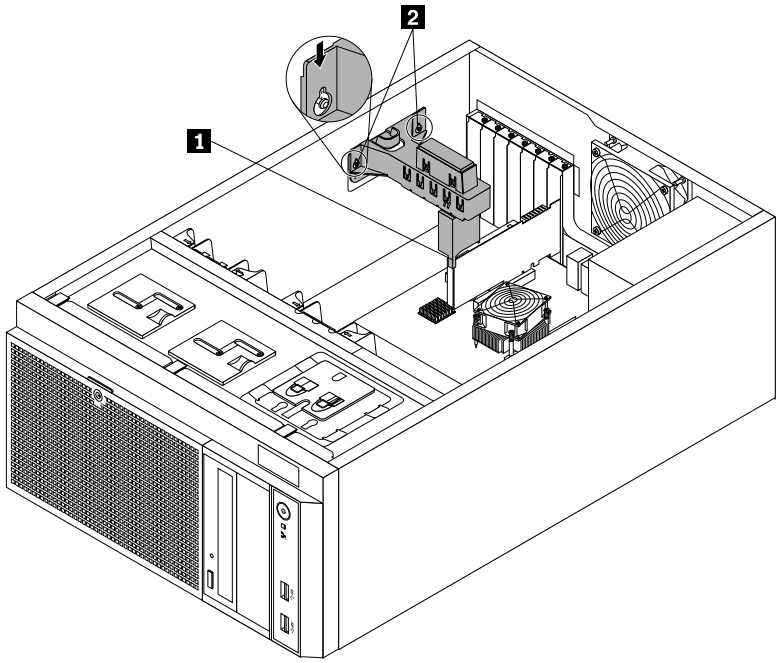


Figure 33. Reinstalling the PCI card bracket assembly

6. Go to “Completing the parts replacement” on page 163.

Installing, removing, or replacing hardware

This topic provides instructions on how to install, remove, or replace hardware for your server. You can expand the capabilities of your server by adding new hardware devices, such as memory modules, PCI cards, or other server options, and maintain your server by replacing the failing hardware devices.

If you are handling a server option, refer to the appropriate installation and or removal instructions in this topic along with the instructions that come with the option.

Notes:

1. Use only parts provided by Lenovo.
2. Depending on the model, your server might look slightly different from the illustrations in this topic.

The EMI integrity and cooling of the server are protected by having all drive bays and PCI Express card slots covered or occupied. When you install an internal drive or a PCI Express card, save the EMI shield or dummy tray from the drive bay or save the PCI Express card slot bracket in case you later remove the device.

Attention: An unoccupied drive bay or PCI Express card slot without a cover, shield, dummy tray, filler, or any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage.

Installing or removing a memory module

This topic provides instructions on how to install or remove a memory module.

Note: The memory modules are sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 66 first and carefully perform the operation.

Memory module installation rules

Your server has four memory slots to provide the following features:

- Each slot supports 2 GB, 4 GB, and 8 GB DDR3 unbuffered dual inline memory modules (UDIMMs) with Error Checking and Correcting (ECC) technology.
- The minimum system memory is 2 GB (only one 2 GB memory module installed in the DIMM2 slot).
- The maximum system memory is 32 GB (one 8 GB memory module installed in each of the four memory slots).

For more information about the memory modules in your specific server model, use the Setup Utility program. See “Viewing information in the Setup Utility program” on page 47.

For a list of supported ThinkServer memory module options, go to:
http://www.lenovo.com/thinkserver

The following illustration shows the locations of all memory slots on the system board.

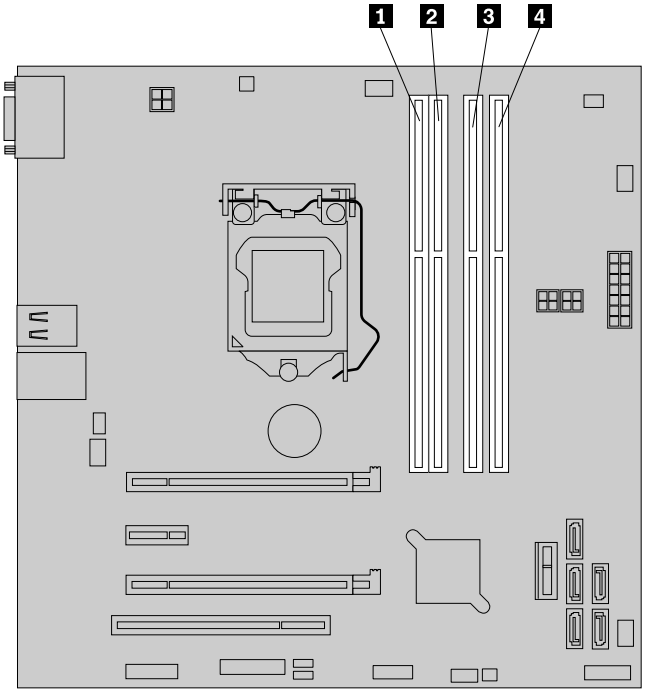


Figure 34. Memory slots on the system board

1 Memory slot (DIMM1)	3 Memory slot (DIMM3)
2 Memory slot (DIMM2)	4 Memory slot (DIMM4)

The following table explains the memory module installation rules for your server. The “X” mark indicates the memory slots into which the memory modules should be installed in different situations.

Table 2. Memory module installation rules

DIMM	DIMM1	DIMM2	DIMM3	DIMM4
One DIMM		X		
Two DIMMs		X		X
Three DIMMs	X	X		X
Four DIMMs	X	X	X	X

Installing a memory module

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to install a memory module.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- To optimize system performance, ensure that you consider and follow the memory module installation rules when performing the operation. See “Memory module installation rules” on page 74.
- Use any documentation that comes with the memory module and follow those instructions in addition to the instructions in this topic.

To install a memory module, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Locate the memory slots on the system board. See “System board components” on page 39.
5. Disconnect any cables that might impede your access to the memory slots.
6. Open the retaining clips of the appropriate memory slot.

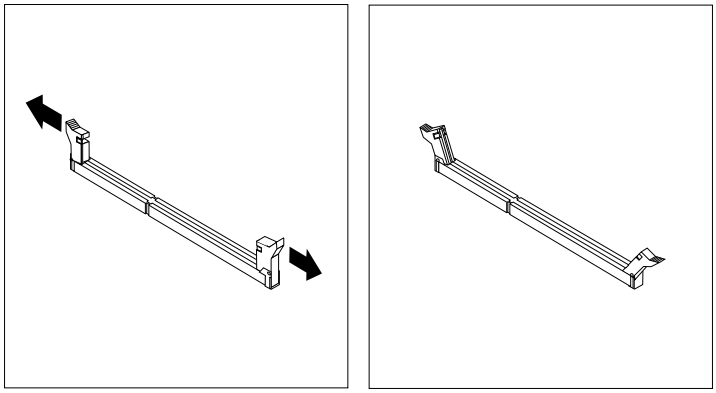


Figure 35. Opening the retaining clips of the memory slot

7. Touch the static-protective package that contains the new memory module to any unpainted surface on the outside of the server. Then, take the new memory module out of the package.

   Note: Carefully handle the memory module by its edges.

8. Position the new memory module over the memory slot. Ensure that the notch 1 on the new memory module is aligned with the key 2 in the memory slot. Then, press the new memory module straight down into the memory slot until the retaining clips close and the new memory module snaps into position.

   Note: If there is a gap between the memory module and the retaining clips, the memory module has not been installed correctly. Open the retaining clips, remove the memory module, and then reinstall it into the memory slot until the retaining clips are closed.

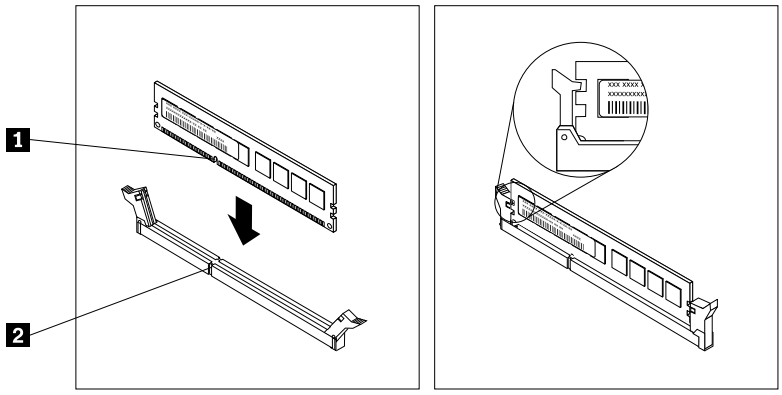


Figure 36. Installing a memory module

9. Reconnect any cables you have disconnected.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation, go to "Completing the parts replacement" on page 163.

Removing a memory module

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to remove a memory module.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Ensure that you consider and follow the memory module installation rules when performing the operation. See "Memory module installation rules" on page 74.

To remove a memory module, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See "Removing the server cover" on page 67.
3. Lay the server on its side for easier operation.
4. Locate the memory slots on the system board. See "System board components" on page 39.
5. Disconnect any cables that might impede your access to the memory slots.

6. Locate the memory module that you want to remove and open the retaining clips on both ends of the memory slot. Then, grasp the memory module by its edges and carefully pull it straight up to remove it from the memory slot.

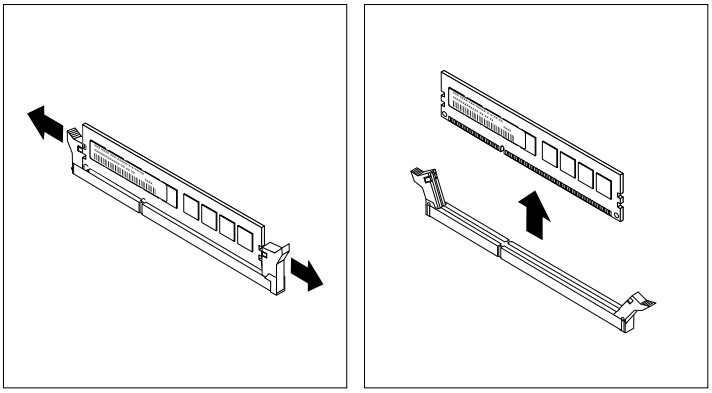


Figure 37. Removing a memory module

7. Reconnect any cables you have disconnected.
8. If you are instructed to return the old memory module, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the removal procedure, go to "Completing the parts replacement" on page 163.

Installing or removing the Ethernet card

This topic provides instructions on how to install or remove the Ethernet card. If you are installing or removing any other types of supported PCI Express cards, the procedure is similar.

Note: The Ethernet card is sensitive to ESD. Ensure that you read and understand "Handling static-sensitive devices" on page 66 first and carefully perform the operation.

Installing the Ethernet card

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to install the Ethernet card.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the specific type, the Ethernet card might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the Ethernet card and follow those instructions in addition to the instructions in this topic.

To install the Ethernet card, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. If a PCI card bracket assembly is installed in your server, remove the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
5. Locate a PCI Express card slot on the system board for installing the Ethernet card. You can install the Ethernet card to the PCI-E slot 2 that supports a card with 167 mm (6.57 inches) in length. See “System board components” on page 39 to identify the different types of PCI card slots in your server.
6. Remove any parts or disconnect any cables that might impede your operation.
7. Remove the PCI Express card slot bracket by removing the screw that secures the metal bracket and then lifting the bracket out of the chassis. Store the PCI Express card slot bracket in case you later remove the Ethernet card and need the bracket to cover the place.

   Note: Carefully place the removed screw aside. You will need the screw later to secure the Ethernet card in place.

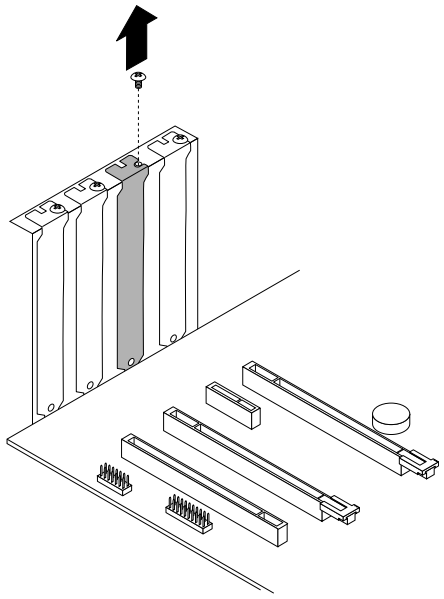


Figure 38. Removing a PCI Express card slot bracket

8. Touch the static-protective package that contains the Ethernet card to any unpainted surface on the outside of the server. Then, take the Ethernet card out of the package.

   Note: Carefully handle the Ethernet card by its edges.

9. Position the new Ethernet card over the PCI Express card slot for which you have removed the slot bracket, and then carefully press the Ethernet card straight down until it is securely seated in the slot. Install the screw to secure the Ethernet card in place.

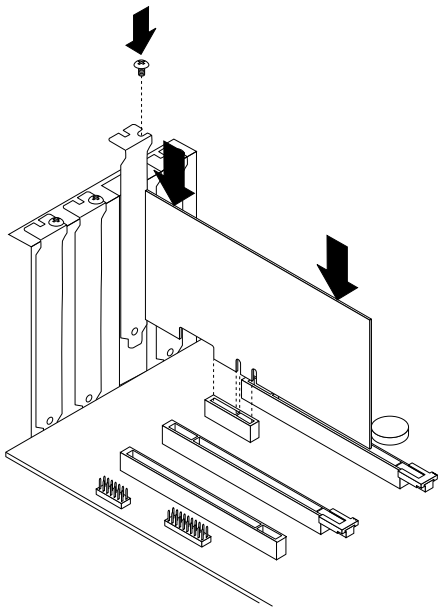


Figure 39. Installing the Ethernet card

10. Depending on the type of the Ethernet card, you might need to connect any required cables. Refer to the documentation that comes with the Ethernet card for specific information.
11. Install the PCI card bracket assembly if a RAID card is installed in your server. See “Removing and reinstalling the PCI card bracket assembly” on page 71.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation, go to “Completing the parts replacement” on page 163. Then, continue with the following procedure to install the Ethernet card driver if required.

To install the required device driver for the Ethernet card, do one of the following:

Note: You do not need to use the driver disc that might come with the Ethernet card.

- If you are using a Windows operating system, run the *ThinkServer EasyStartup* DVD that comes with your server and follow the instructions on the screen to download and install the required Ethernet card driver to the server. For more information, see “Using the ThinkServer EasyStartup program on a Windows operating system” on page 56.
- If you are using a Linux operating system, run the *ThinkServer EasyStartup* DVD that comes with your server on a computer with a Windows operating system and download the required Ethernet card driver to a removable storage device. Then, transfer the Ethernet card driver from the removable storage device to your server and run the driver file to install the driver.

The most up-to-date device drivers for various server models are always available for download on the Lenovo Support Web site at:
http://www.lenovo.com/drivers

Removing the Ethernet card

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to remove the Ethernet card.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the specific type, the Ethernet card might look slightly different from the illustration in this topic.
- Use any documentation that comes with the Ethernet card and follow those instructions in addition to the instructions in this topic.

To remove the Ethernet card, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See "Removing the server cover" on page 67.
3. Lay the server on its side for easier operation.
4. If a PCI card bracket assembly is installed in your server, remove the PCI card bracket assembly. See "Removing and reinstalling the PCI card bracket assembly" on page 71.
5. Locate the Ethernet card. The Ethernet card is in the PCI-E slot 2 that supports a card with 167 mm (6.57 inches) in length. See "System board components" on page 39.
6. Depending on the type of the Ethernet card, you might also need to disconnect all cables from the Ethernet card, the system board, and or the hot-swap hard-disk-drive backplane.

7. Remove the screw that secures the Ethernet card. Then, grasp the Ethernet card by its edges and carefully pull it out of the PCI Express card slot.

   Note: The Ethernet card fits tightly into the PCI Express card slot. If necessary, alternate moving each side of the Ethernet card a small and equal amount until it is completely removed from the slot.

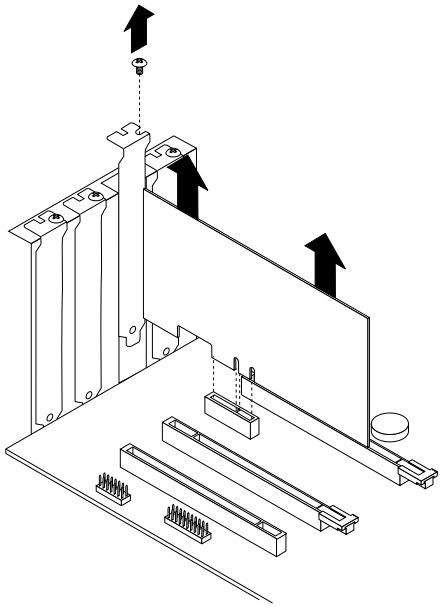


Figure 40. Removing the Ethernet card

8. Install a new Ethernet card to replace the old one or install a PCI Express card slot bracket to cover the place. See “Installing the Ethernet card” on page 78.
9. Install the PCI card bracket assembly if a RAID card is installed in your server. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
10. If you are instructed to return the old Ethernet card, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the removal procedure, go to “Completing the parts replacement” on page 163.

Installing or removing the RAID card

This topic provides instructions on how to install or remove the RAID card.

A specific RAID card is required for server models with more than four SATA hard disk drives or models that use SAS hard disk drives. You also can purchase a supported RAID card from Lenovo and install it into the server for advanced SATA/SAS hardware RAID functions. For more information, see “RAID card” on page 30 and “Configuring RAID” on page 57.

Note: The RAID card is sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 66 first and carefully perform the operation.

Installing the RAID card

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to install the RAID card.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Ensure that you back up your data before installing the RAID card because you might need to reconfigure RAID and reinstall the operating system after installing the RAID card.
- Use any documentation that comes with the RAID card and follow those instructions in addition to the instructions in this topic.

To install the RAID card, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See "Removing the server cover" on page 67.
3. Lay the server on its side for easier operation.
4. Locate the PCI-E slot 1 on the system board. See "System board components" on page 39.
5. Remove any parts or disconnect any cables that might impede your operation.
6. Touch the static-protective package that contains the RAID card to any unpainted surface on the outside of the server. Then, take the RAID card out of the package.

   Note: Carefully handle the RAID card by its edges.
7. Install the RAID card. The procedure is similar to that of the Ethernet card. See "Installing the Ethernet card" on page 78.
8. Connect signal cables to the connectors on the new RAID card and the connectors on the hot-swap hard-disk-drive backplanes. See "Connecting the cables" on page 36.
9. Install the PCI card bracket assembly that comes with the RAID card. See "Removing and reinstalling the PCI card bracket assembly" on page 71.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation, go to "Completing the parts replacement" on page 163. Then, configure RAID for your server. See "Configuring RAID" on page 57.

Removing the RAID card

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to remove the RAID card. This topic applies only to models that have a RAID card installed.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Ensure that you back up your data before removing the RAID card because you might need to reconfigure RAID and reinstall the operating system after removing the RAID card.
- If you remove the RAID card, you will lose the advanced SATA/SAS hardware RAID functions.
- Use any documentation that comes with the RAID card and follow those instructions in addition to the instructions in this topic.

To remove the RAID card, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
5. Locate the RAID card, which is installed in the PCI-E slot 1 on the system board. See “System board components” on page 39.
6. Remove any parts or disconnect any cables that might impede your operation.
7. Disconnect all cables from the RAID card and any other related parts.

   Note: If you want to install a new RAID card after removing the old one, record the cable connections before disconnecting the cables.
8. Remove the RAID card. The procedure is similar to that of the Ethernet card. See “Removing the Ethernet card” on page 81.

   Note: Carefully handle the RAID card by its edges.
9. Depending on your needs, do one of the following:
   - Install a new RAID card to replace the old one and reconnect cables. See “Installing the RAID card” on page 83.
   - Install a PCI Express card slot bracket to cover the place and connect related cables to the system board and the backplane. See “Connecting the cables” on page 36.
10. If you are instructed to return the old RAID card, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the removal procedure, go to “Completing the parts replacement” on page 163. Then, you need to reconfigure RAID for your server. See “Configuring RAID” on page 57.

Installing or removing the ThinkServer RAID 500 Upgrade Key for Advanced RAID

This topic provides instructions on how to install or remove the ThinkServer RAID 500 Upgrade Key for Advanced RAID (hereinafter referred to as the TR 500 key).

The TR 500 Key expands the capability of the ThinkServer RAID 500 Adapter by activating RAID 5 and RAID 50 for advanced SATA/SAS hardware RAID. You can purchase a TR 500 Key from Lenovo.

Installing the TR 500 key

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to install the TR 500 key on a ThinkServer RAID 500 Adapter if your server has one installed.

Attention: Back up your data before you begin if you want to reconfigure RAID and reinstall the operating system after installing the TR 500 Key.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Use any documentation that comes with the TR 500 key and follow those instructions in addition to the instructions in this topic.

To install the TR 500 key, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
5. Locate the ThinkServer RAID 500 Adapter, which is installed in the PCI-E slot 1 on the system board. See “System board components” on page 39.
6. Remove any parts or disconnect any cables that might impede your operation.
7. Touch the static-protective package that contains the TR 500 key to any unpainted surface on the outside of the server. Then, take the TR 500 key out of the package.

   Note: Carefully handle the TR 500 key by its edges.

8. Locate the TR 500 key connector on the ThinkServer RAID 500 Adapter and then carefully insert the TR 500 key into the connector. If necessary, you can remove the ThinkServer RAID 500 Adapter first, install the TR 500 Key on it, and then reinstall the ThinkServer RAID 500 Adapter. See “Installing or removing the RAID card” on page 82.

   Note: Ensure that the TR 500 key is securely seated on the ThinkServer RAID 500 Adapter.

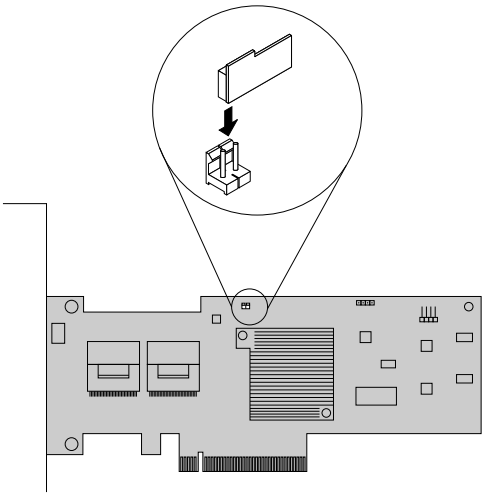


Figure 41. Installing the TR 500 key

9. Reinstall any parts or reconnect any cables that you have removed.
10. Reinstall the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation, go to “Completing the parts replacement” on page 163. Then, the hardware RAID 5 and RAID 50 levels are available for your server if your server has the required number of hard disk drives installed. For information about how to configure the hardware RAID, refer to the *MegaRAID SAS Software User Guide* on the documentation DVD that comes with your server.

Removing the TR 500 Key

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to remove the TR 500 Key if your server has a ThinkServer RAID 500 Adapter with a TR 500 Key option installed.

Attention: Back up your data before you begin if you need to reconfigure RAID and reinstall the operating system after removing the TR 500 Key.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- If you remove the TR 500 Key from the ThinkServer RAID 500 Adapter, the hardware RAID 5 and RAID 50 levels will be disabled.

- Use any documentation that comes with the TR 500 Key and follow those instructions in addition to the instructions in this topic.

To remove the TR 500 Key, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
5. Locate the ThinkServer RAID 500 Adapter, which is installed in the PCI-E slot 1 on the system board. See “System board components” on page 39.
6. Remove any parts or disconnect any cables that might impede your operation.
7. Remove the TR 500 Key from the ThinkServer RAID 500 Adapter. If necessary, you can remove the ThinkServer RAID 500 Adapter first, remove the TR 500 Key from it, and then reinstall the ThinkServer RAID 500 Adapter. See “Installing or removing the RAID card” on page 82.

   Note: Carefully handle the TR 500 Key by its edges.

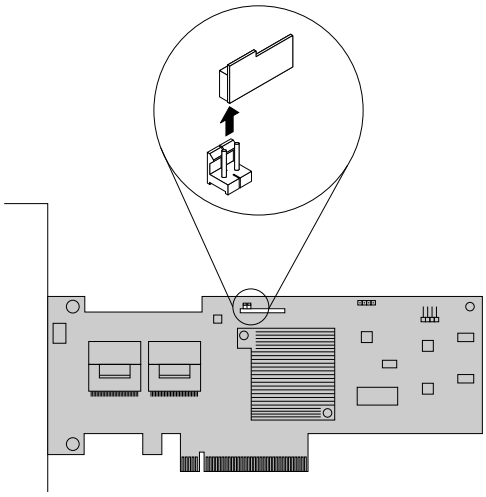


Figure 42. Removing the TR 500 Key from the ThinkServer RAID 500 Adapter

8. Reinstall any parts or reconnect any cables that you have removed.
9. Reinstall the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
10. If you are instructed to return the old TR 500 Key, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the removal procedure, go to “Completing the parts replacement” on page 163. Because the hardware RAID 5 and 50 levels are not available without the TR 500 key, you might need to reconfigure RAID for your server. For information about how to configure the hardware RAID, refer to the *MegaRAID SAS Software User Guide* on the documentation DVD that comes with your server.

Installing or removing the ThinkServer RAID 700 Battery

This topic provides instructions on how to install or remove the ThinkServer RAID 700 Battery (hereinafter referred to as the TR 700 Battery) if your server has a ThinkServer RAID 700 Adapter installed.

The TR 700 Battery protects the integrity of the cached data on the ThinkServer RAID 700 Adapter by providing backup power up to 72 hours in the case of a complete ac power failure or a brief power outage. It has built-in functionality to automatically charge the battery pack and to communicate battery status information (such as voltage, temperature, and current) to your server. It also provides an inexpensive alternative to using an uninterruptible power supply, and a second level of fault tolerance when used with an uninterruptible power supply.

The temperature of the TR 700 Battery is generally 15-20°C (59-68°F) higher than the ambient temperature during fast charge. Therefore, to complete a recharge cycle, the ambient temperature should be lower than 55°C (131°F). If the ambient temperature exceeds 55°C (131°F), the recharge cycle will terminate prematurely, thus preventing the TR 700 Battery from reaching a fully charged state. A recharge cycle lasts at least six hours under normal operating conditions.

Attention: It is recommended that you replace the TR 700 Battery annually or after 500 recharging cycles, whichever comes first.

Installing the TR 700 Battery

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to install the TR 700 Battery on a ThinkServer RAID 700 Adapter if your server has one installed.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Use any documentation that comes with the TR 700 Battery and follow those instructions in addition to the instructions in this topic.

To install the TR 700 Battery, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
5. Locate the ThinkServer RAID 700 Adapter, which is located in the PCI-E slot 1 on the system board.
6. Remove the ThinkServer RAID 700 Adapter, which is a kind of RAID card. See “Installing or removing the RAID card” on page 82.

   Note: Carefully handle the ThinkServer RAID 700 Adapter by its edges and place it on a flat, clean, and static-protective surface after you remove it.
7. Touch the static-protective package that contains the TR 700 Battery to any unpainted surface on the outside of the server. Then, take the TR 700 Battery out of the package.

8. Position the TR 700 Battery above the ThinkServer RAID 700 Adapter so that the board-to-board connector 1 on the bottom of the TR 700 Battery is aligned with the connector 2 on the ThinkServer RAID 700 Adapter; and the three mounting studs on the bottom of the TR 700 Battery are aligned with the corresponding holes in the ThinkServer RAID 700 Adapter. Carefully press the TR 700 Battery onto the ThinkServer RAID 700 Adapter until the two connectors (1 and 2) are firmly joined. Then, install the three screws that come with the TR 700 Battery option kit to secure the TR 700 Battery in place.

   Notes:

   - Center the screwdriver when you install the screws and do not over-tighten the screws to avoid possible damage to any parts.
   - Do not touch the board on the bottom of the TR 700 Battery.

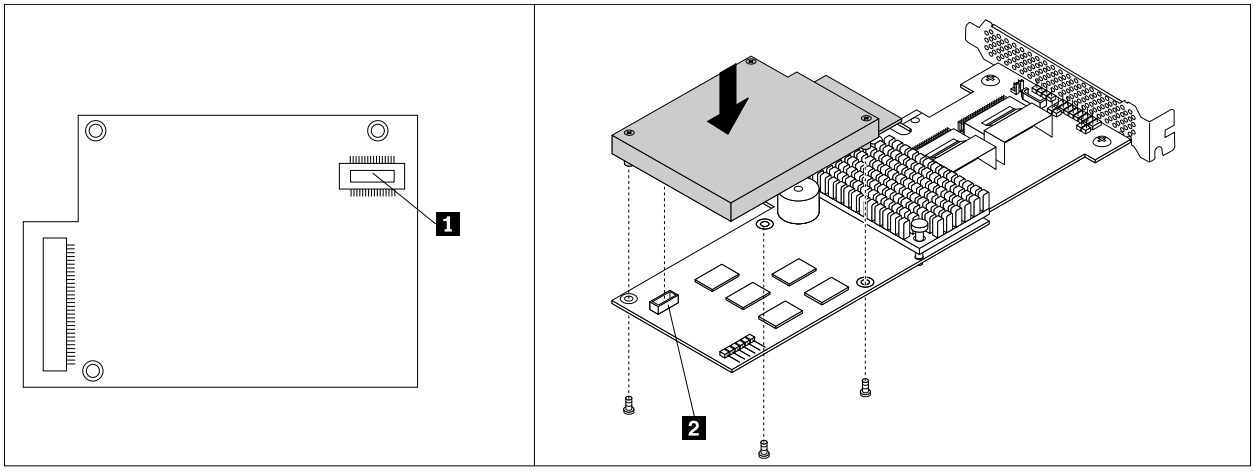


Figure 43. Installing the TR 700 Battery

9. Reinstall the ThinkServer RAID 700 Adapter with the TR 700 Battery. See “Installing or removing the RAID card” on page 82.
10. Reinstall the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation, go to “Completing the parts replacement” on page 163.

Removing the TR 700 Battery

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to remove the TR 700 Battery if your server has a ThinkServer RAID 700 Adapter with a TR 700 Battery option installed.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- If you remove the TR 700 Battery, you will lose the backup power for the ThinkServer RAID 700 Adapter.
- Use any documentation that comes with the TR 700 Battery and follow those instructions in addition to the instructions in this topic.

To remove the TR 700 Battery, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
5. Locate the ThinkServer RAID 700 Adapter, which is located in the PCI-E slot 1 on the system board.
6. Remove the ThinkServer RAID 700 Adapter, which is a kind of RAID card. See “Installing or removing the RAID card” on page 82.
7. Carefully remove the three screws that secure the TR 700 Battery and then remove the TR 700 Battery from the ThinkServer RAID 700 Adapter.

   Note: Center the screwdriver when you remove the screws to avoid possible damage to any parts.

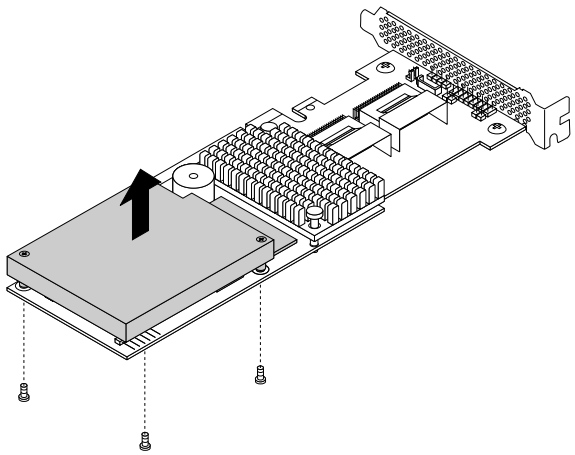


Figure 44. Removing the TR 700 Battery

8. If you want to install a new TR 700 Battery, see “Installing the TR 700 Battery” on page 88.
9. Reinstall the ThinkServer RAID 700 Adapter with a new TR 700 Battery or without a TR 700 Battery. See “Installing or removing the RAID card” on page 82.
10. Reinstall the PCI card bracket assembly. See “Removing and reinstalling the PCI card bracket assembly” on page 71.
11. If you are instructed to return the old TR 700 Battery, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the removal procedure, go to “Completing the parts replacement” on page 163.

Installing or replacing an optical drive

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to install or replace an optical drive.

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. Your server has two optical drive bays. If only one optical drive is installed in the lower bay, the upper bay is covered by a metal EMI shield on the chassis and also a plastic shield on the front bezel. When you install a secondary optical drive, save the removed EMI shield from the chassis and plastic shield from the front bezel in case you later remove the drive and need the shields to cover the drive bay.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new optical drive as soon as you remove the failing one or the protective shields.

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following:

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Before you begin, review the following optical drive installation rules:

- The server has two optical drive bays. If the server has only one optical drive installed, ensure that the optical drive is installed in the lower bay (optical drive bay 1). The upper bay is for a secondary optical drive only.
- The following table provides information about the recommended power connector and connector on the system board for the installed optical drive. See "Server components" on page 23 for the locations of the optical drive bays and "System board components" on page 39 for the locations of the connectors on the system board.

Drive bay	Drive	Power connector	Connector on the system board
Optical drive bay 1 (lower bay)	An optical drive installed	4-pin power connector	SATA 4 connector
Optical drive bay 2 (upper bay)	An optical drive installed in some models		SATA 3 connector

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the model, your server might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the optical drive and follow those instructions in addition to the instructions in this topic.

To install or replace an optical drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Locate the optical drive bays. See “Server components” on page 23.
4. Depending on whether you are installing or replacing an optical drive, do one of the following:
   - If you are installing a secondary optical drive in the upper optical drive bay, remove the front bezel. See “Removing and reinstalling the front bezel” on page 69. Then, remove the plastic shield for the bay from the front panel. Remove the screw **1** that secures the metal EMI shield covered on the upper optical drive bay. Insert a finger into the hole in the EMI shield and carefully pull the EMI shield out of the front of the chassis.

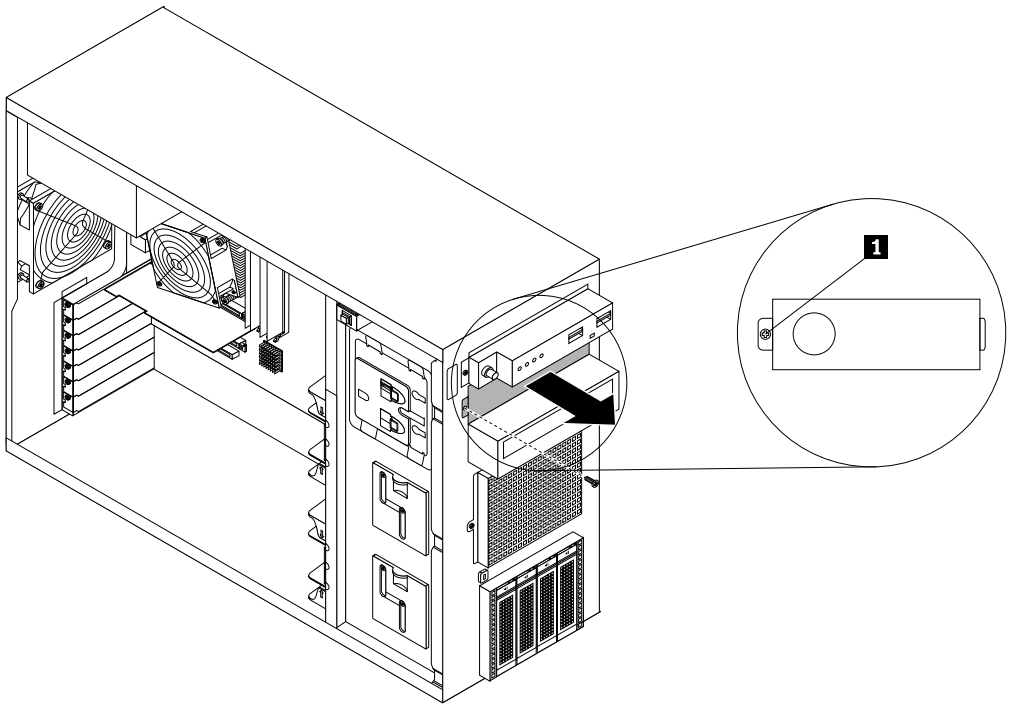


Figure 45. Removing the EMI shield for the upper optical drive bay

- If you are replacing an optical drive, disconnect the signal cable and the power cable from the rear of the optical drive. Press the release button 1 in the direction as shown and push the optical drive from the rear until it is projected from the front of the chassis. Then, hold the optical drive from the front and completely slide it out of the chassis.

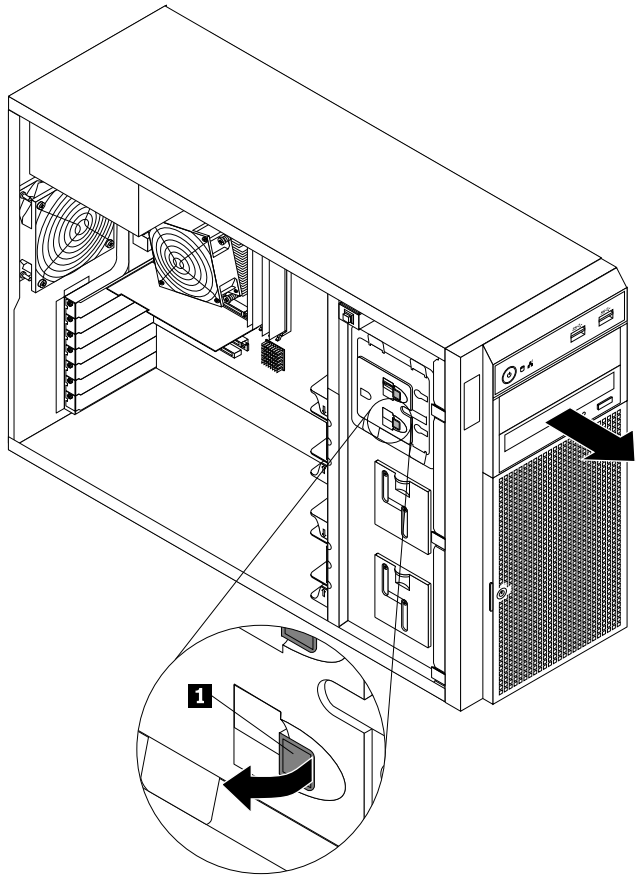


Figure 46. Removing the optical drive

5. Touch the static-protective package that contains the new optical drive to any unpainted surface on the outside of the server. Then, take the new optical drive and the signal cable out of the package.

6. Slide the new optical drive into the drive bay from the front until it snaps into position.

   Note: You do not need to remove the front bezel when replacing an optical drive. However, if you are adding a secondary optical drive in the upper optical drive bay, you need to remove the front bezel first, and then gain access to the protective shields to remove them. The following illustration shows only the situation in which the front bezel has not been removed.

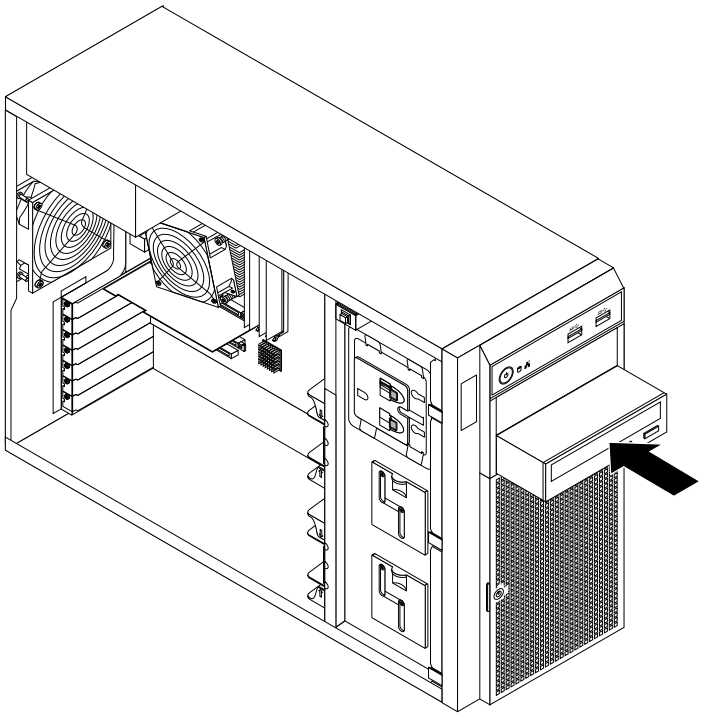


Figure 47. Installing the optical drive

7. Connect the power cable **1** and the signal cable **2** to the rear of the new optical drive.

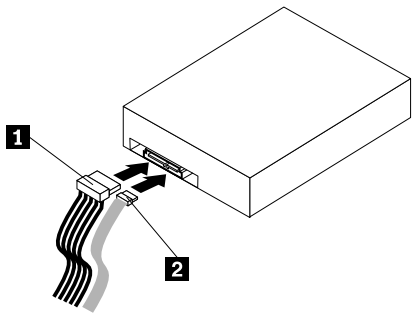


Figure 48. Connecting cables to the rear of the optical drive

8. If necessary, connect the other end of the signal cable to the appropriate SATA connector on the system board. See “System board components” on page 39.
9. Reinstall the front bezel if you have removed it. See “Removing and reinstalling the front bezel” on page 69.
10. Do one of the following:

- If you are installing an optical drive, save the removed EMI-protective shield from the chassis and plastic shield from the front bezel in case you later remove the drive and need the shields to cover the drive bay.
- If you are replacing an optical drive and are instructed to return the old optical drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 163.

Installing or removing a non-hot-swap hard disk drive

This topic provides instructions on how to install or remove a non-hot-swap hard disk drive.

This topic applies only to server models that support non-hot-swap hard disk drives. See "Features" on page 7 for more information about the supported non-hot-swap hard disk drives.

For a list of ThinkServer hard-disk-drive options, go to:
http://www.lenovo.com/thinkserver

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. The number of the installed hard disk drives in your server varies depending on the server model. The vacant bays are covered by an EMI-protective panel.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new non-hot-swap hard disk drive as soon as you remove the failing one.

Installing a non-hot-swap hard disk drive

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to install a non-hot-swap hard disk drive.

Before you begin, review the following hard-disk-drive installation rules:

- Follow the order of the hard-disk-drive bays when installing a hard disk drive. See "Server components" on page 23 to locate the hard-disk-drive bays in your server.
- For RAID configuration, the hard disk drives must be the same type with the same capacity if they are within a single RAID array. For more information, see "Configuring RAID" on page 57.
- For hard disk drives with different capacities, install the hard disk drive by following the order of the hard-disk-drive bays as well as the order from the lowest capacity to the highest capacity.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the model, your server might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the hard disk drive and follow those instructions in addition to the instructions in this topic.

To install a non-hot-swap hard disk drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Use the front door key to unlock the front door, and then use the front door handle **1** to pivot the front door to the open position.

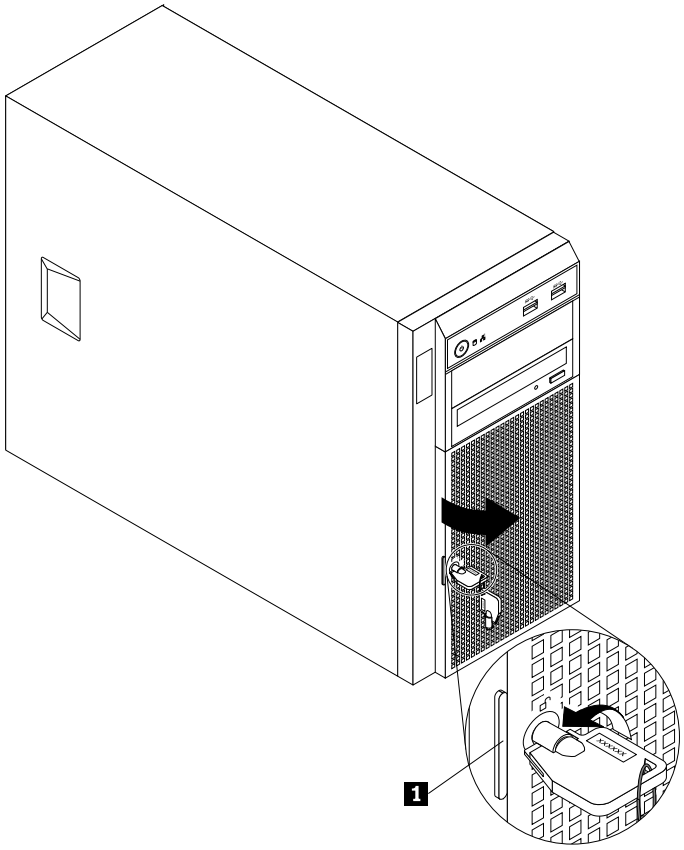


Figure 49. Opening the front door of the server

3. Remove the server cover. See “Removing the server cover” on page 67.

4. The non-hot-swap hard disk drives are installed in the lower hard-disk-drive cage and are protected by an EMI-protective panel. Press the small tab **1** on the EMI-protective panel from the bottom, and then pivot the EMI-protective panel upward to remove it from the chassis and gain access to the non-hot-swap hard-disk-drive bays.

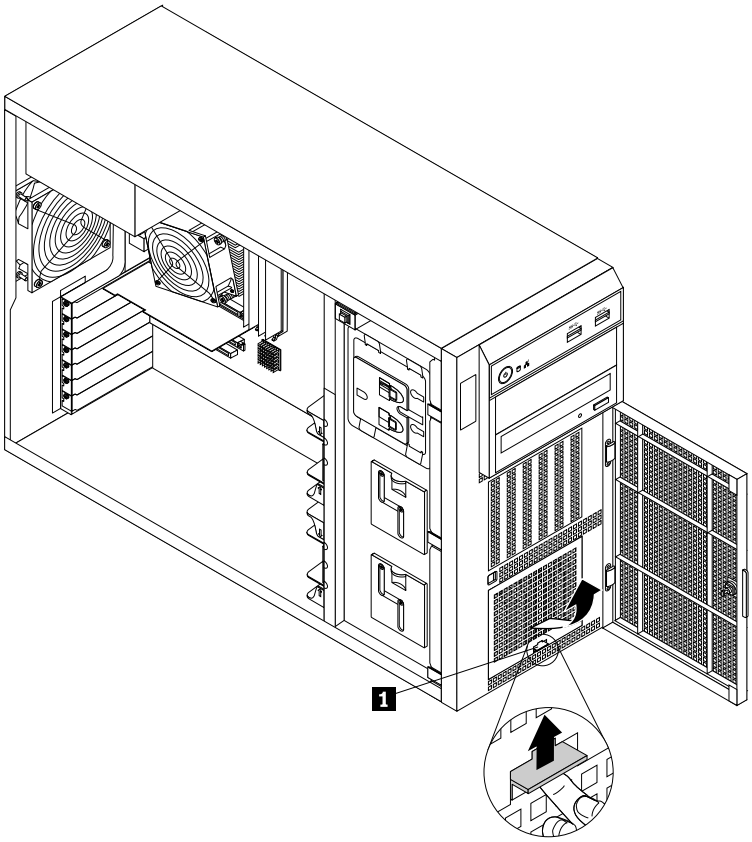


Figure 50. Removing the EMI-protective panel

5. Remove the front system fan 1. See “Replacing the front system fan 1” on page 144.
6. Locate the non-hot-swap hard-disk-drive bay. See “Server components” on page 23.
7. Touch the static-protective package that contains the new non-hot-swap hard disk drive to any unpainted surface on the outside of the server. Then, take the new non-hot-swap hard disk drive and the signal cable out of the package.

   Note: Do not touch the circuit board on the hard disk drive.

8. Install the new non-hot-swap hard disk drive into a blue bracket by flexing the sides of the bracket and aligning pin 1, pin 2, pin 4, and pin 5 on the bracket with the corresponding holes in the hard disk drive so that the hard disk drive can be seated in the bracket.

   Note: Do not touch the circuit board 3 on the bottom of the hard disk drive.

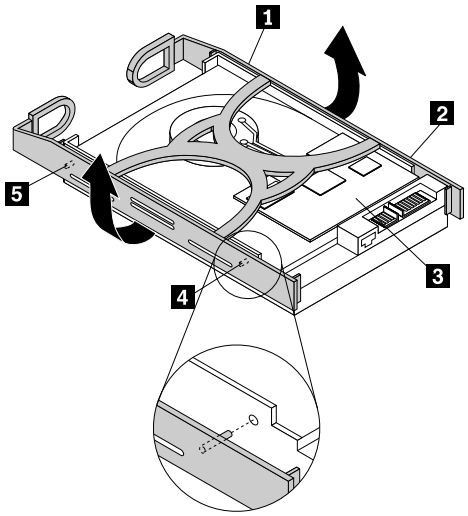


Figure 51. Installing the non-hot-swap hard disk drive into the bracket

9. Slide the new non-hot-swap hard disk drive with bracket into the drive bay until it snaps into position.
10. Connect the power cable 1 and the SATA signal cable 2 to the rear of the non-hot-swap hard disk drive. See “Connecting the cables” on page 36

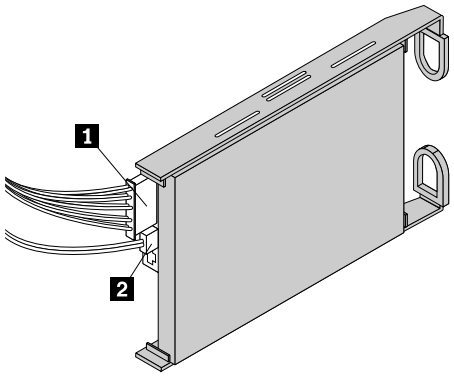


Figure 52. Connecting cables to the rear of the non-hot-swap hard disk drive

11. Connect the other end of the SATA signal cable to the appropriate SATA connector on the system board. See “System board components” on page 39.
12. Reinstall the front system fan 1. See “Replacing the front system fan 1” on page 144.

13. Align the top edge of the EMI-protective panel with the top side of the hard-disk-drive cage, and then pivot the EMI-protective panel down until it snaps into position.

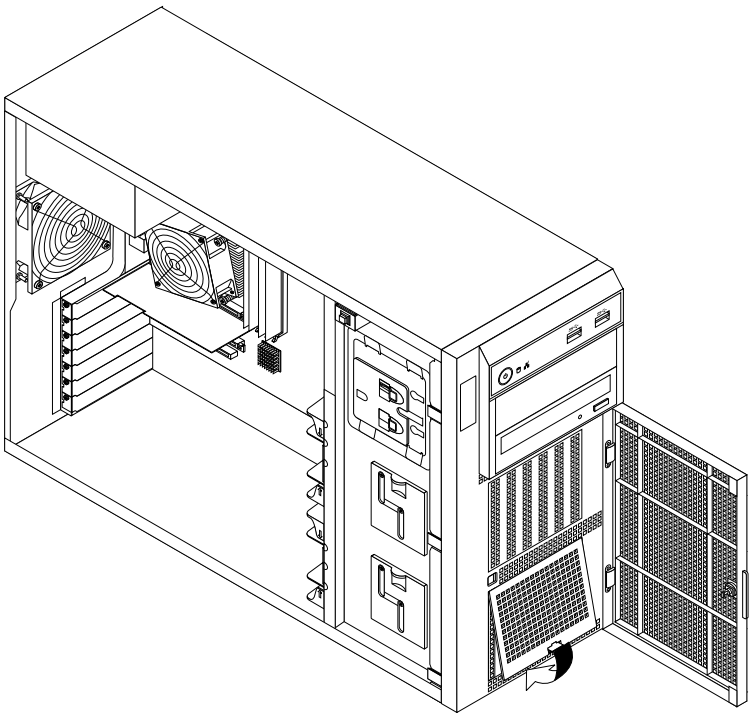


Figure 53. Installing the EMI-protective panel

14. Close and lock the front door.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation, go to "Completing the parts replacement" on page 163. Then, you might need to reconfigure RAID for your server. See "Configuring RAID" on page 57.

Removing a non-hot-swap hard disk drive

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to remove a non-hot-swap hard disk drive.

This topic applies only to server models that have non-hot-swap hard disk drives installed. See "Features" on page 7 for more information about the supported non-hot-swap hard disk drives.

Before you begin, review the following hard-disk-drive installation rules:

- Follow the order of the hard-disk-drive bays when installing a hard disk drive. See "Server components" on page 23 to locate the hard-disk-drive bays in your server.
- For RAID configuration, the hard disk drives must be the same type with the same capacity if they are within a single RAID array. For more information, see "Configuring RAID" on page 57.
- For hard disk drives with different capacities, install the hard disk drive by following the order of the hard-disk-drive bays as well as the order from the lowest capacity to the highest capacity.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the model, your server might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the non-hot-swap hard disk drive and follow those instructions in addition to the instructions in this topic.

To remove a non-hot-swap hard disk drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Use the front door key to unlock the front door, and then use the front door handle **1** to pivot the front door to the open position.

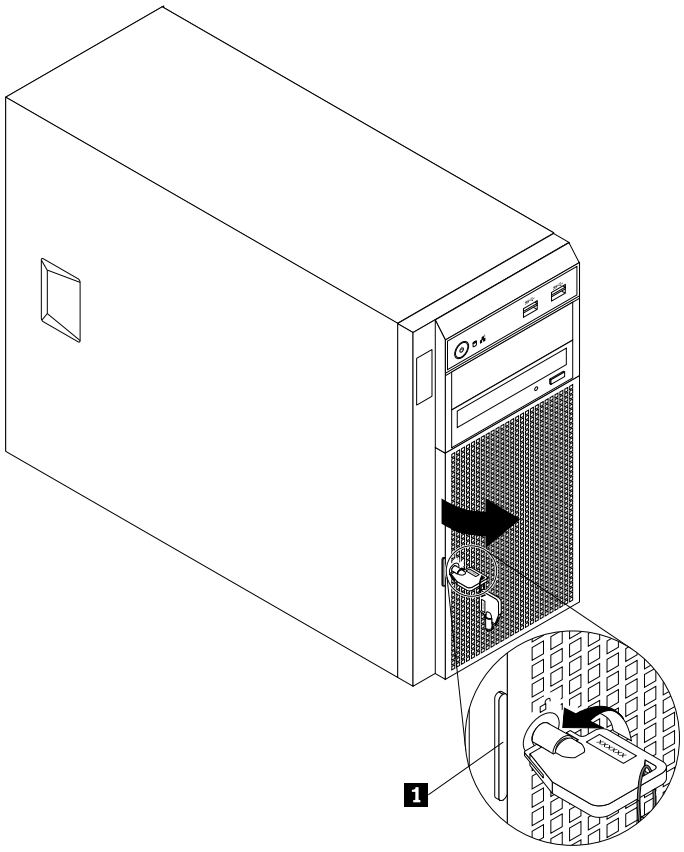


Figure 54. Opening the front door of the server

3. Remove the server cover. See “Removing the server cover” on page 67.

4. The non-hot-swap hard disk drives are installed in the lower hard-disk-drive cage and are protected by an EMI-protective panel. Press the small tab **1** on the EMI-protective panel from the bottom, and then pivot the EMI-protective panel upward to remove it from the chassis and gain access to the non-hot-swap hard disk drives.

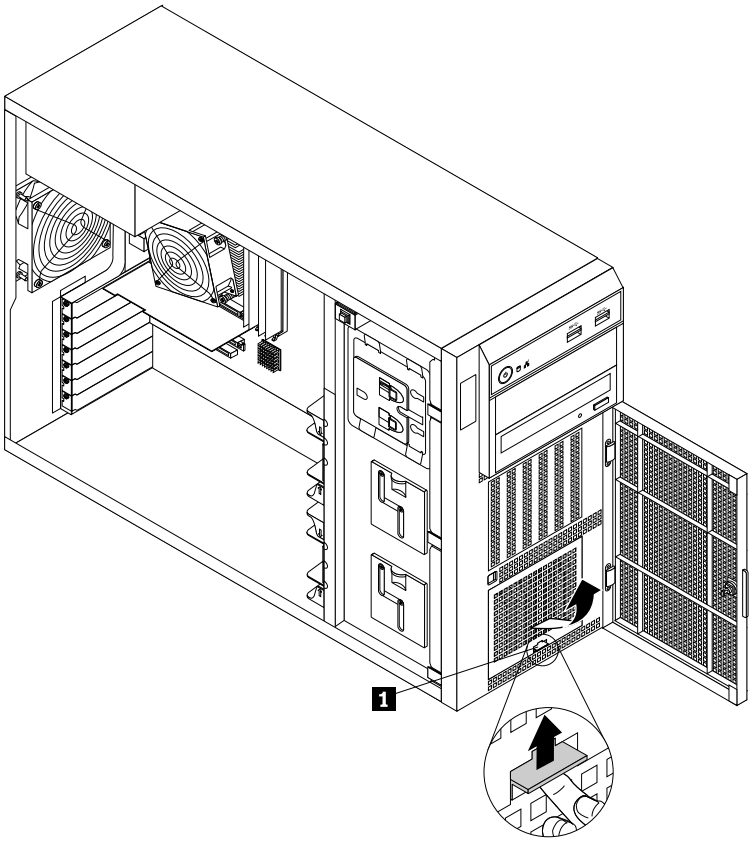


Figure 55. Removing the EMI-protective panel

5. Remove the front system fan 1. See “Replacing the front system fan 1” on page 144.
6. Locate the non-hot-swap hard disk drive. See “Server components” on page 23. Then, disconnect the SATA signal cable and the power cable from the rear of the non-hot-swap hard disk drive.

7. Insert two fingers into the holes in the two tabs on the front of the blue bracket. Then, press the tabs towards each other and carefully slide the non-hot-swap hard disk drive out of the front of the chassis.

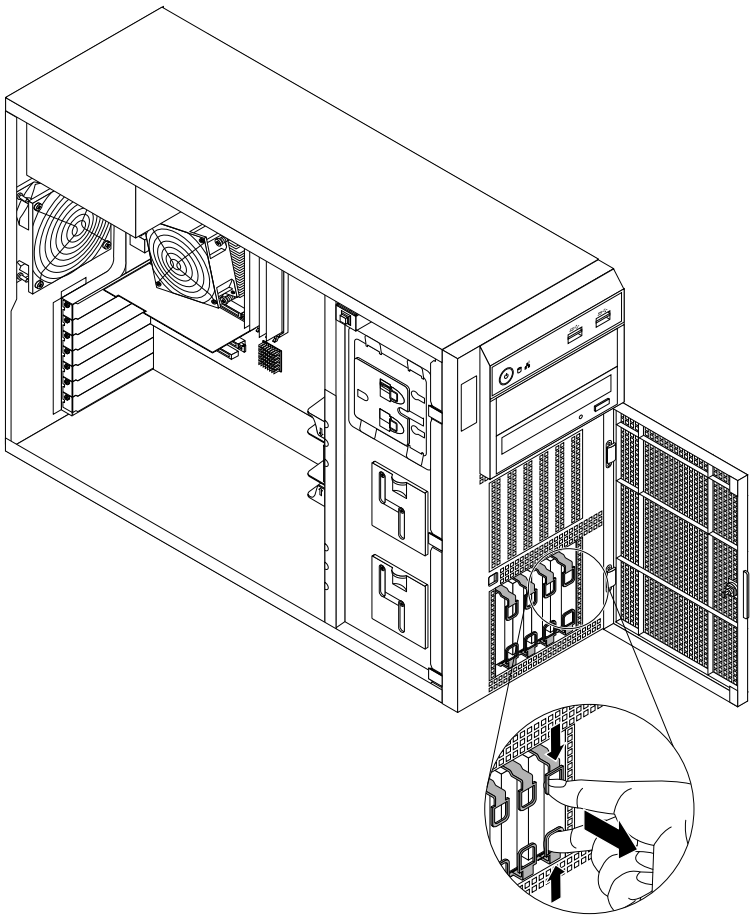


Figure 56. Sliding the non-hot-swap hard disk drive out of the bay

8. Flex the sides of the blue bracket to remove the non-hot-swap hard disk drive from the bracket. Save the bracket for future use.

   Note: Do not touch the circuit board on the hard disk drive.
9. Reinstall the front system fan 1. See “Replacing the front system fan 1” on page 144.

10. Align the top edge of the EMI-protective panel with the top side of the hard-disk-drive cage, and then pivot the EMI-protective panel down until it snaps into position.

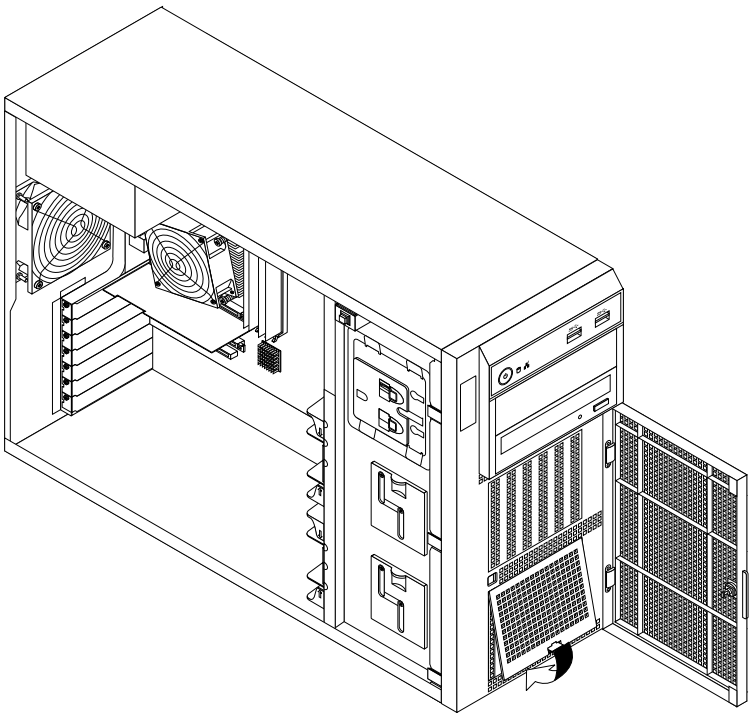


Figure 57. Installing the EMI-protective panel

11. Disconnect the SATA cable for the removed non-hot-swap hard disk drive from the system board and save the cable for future use.
12. Close and lock the front door.
13. If you are instructed to return the old non-hot-swap hard disk drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the removal procedure, go to "Completing the parts replacement" on page 163. Then, you might need to reconfigure RAID for your server. See "Configuring RAID" on page 57.

Installing or replacing an internal RDX drive

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

- The internal RDX drive must be installed in the upper optical drive bay.
- Depending on the model, your server might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the RDX drive and follow those instructions in addition to the instructions in this topic.

To install or replace an internal RDX drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Locate the optical drive bay where you want to install or replace the RDX drive. See “Server components” on page 23.
4. Depending on whether you are installing or replacing an RDX drive, do one of the following:
   - If you are installing an RDX drive, remove the front bezel. See “Removing and reinstalling the front bezel” on page 69. Then, remove the plastic shield for the bay from the front panel. Remove the screw **1** that secures the metal EMI shield covered on the optical drive bay. Insert a finger into the hole in the EMI shield and carefully pull the EMI shield out of the front of the chassis.

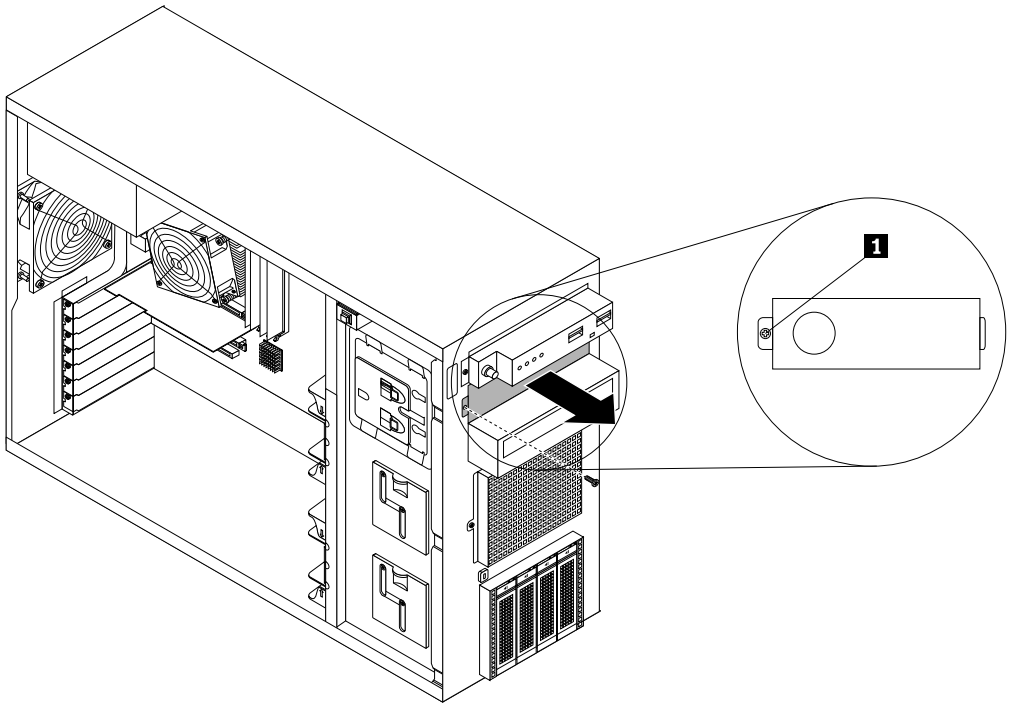


Figure 58. Removing the EMI shield for the upper optical drive bay

- If you are replacing an RDX drive, disconnect the signal cable and the power cable from the rear of the RDX drive. Press the release button **1** in the direction as shown and push the RDX drive from the rear until it is projected from the front of the chassis. Then, hold the RDX drive from the front and completely slide it out of the chassis.

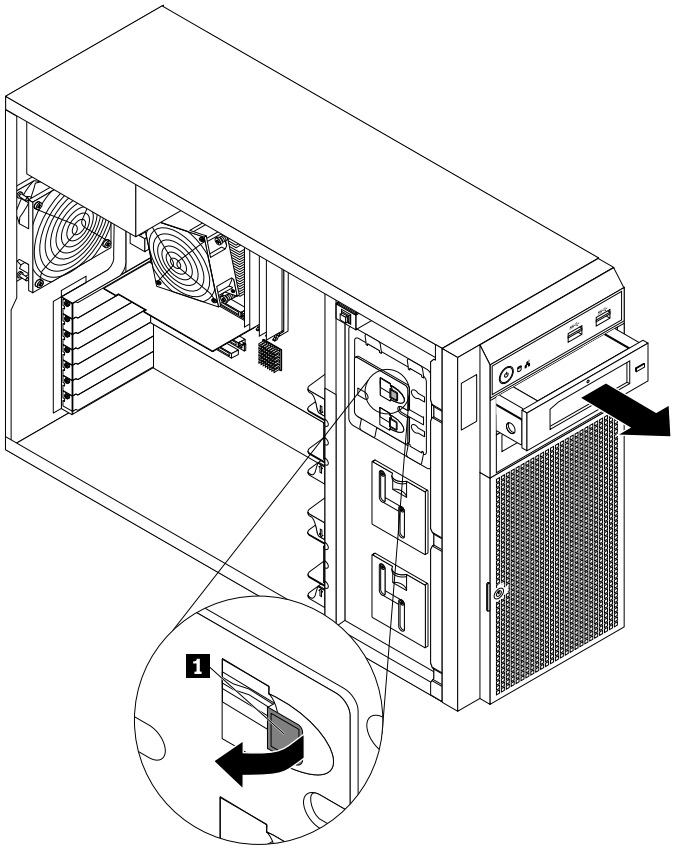


Figure 59. Removing the RDX drive

5. Touch the static-protective package that contains the new RDX drive to any unpainted surface on the outside of the server. Then, take the new RDX drive and the signal cable out of the package.

6. Slide the new RDX drive into the optical drive bay from the front until it snaps into position.

   Note: You do not need to remove the front bezel when replacing an RDX drive. However, if you are installing an RDX drive, you need to remove the front bezel first, and then gain access to the protective shields to remove them. The following illustration shows only the situation in which the front bezel has been removed.

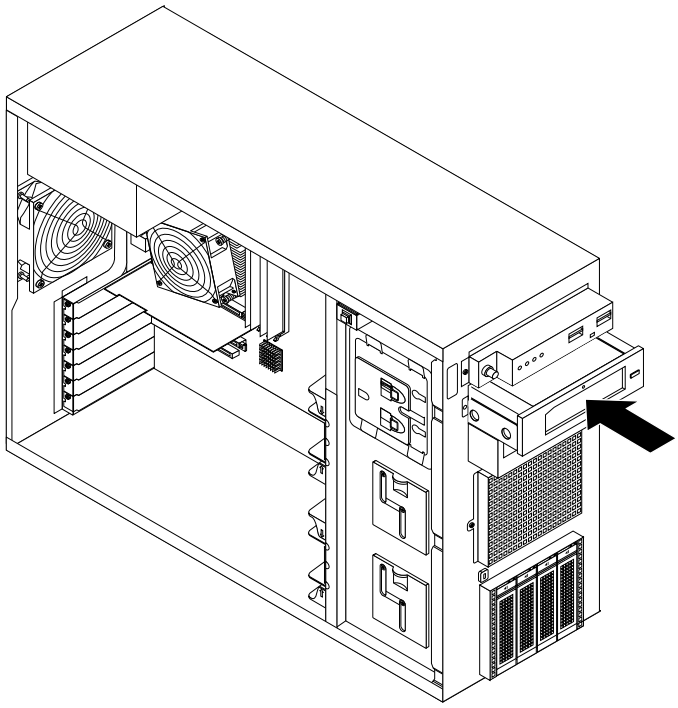


Figure 60. Installing the RDX drive

7. Connect the 4-pin power cable **1** and the signal cable **2** to the rear of the RDX drive.

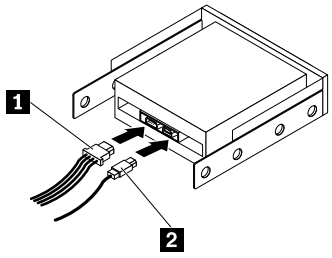


Figure 61. Connecting cables to the rear of the RDX drive

8. If necessary, connect the USB connector on the other end of the signal cable **2** to the USB 2.0 connector on the system board. See “System board components” on page 39.
9. If necessary, connect the 4-pin power connector on one end of the optical drive power cable to the corresponding 4-pin power connector on the system board. Then, connect the power connector on the other end of the power cable **1** to one of the power connectors on the other end of the optical drive power cable. See “System board components” on page 39.
10. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 69.

11. Do one of the following:
    - If you are installing an RDX drive, save the removed EMI-protective shield from the chassis and plastic shield from the front bezel in the event that you later remove the drive and need the shields to cover the drive bay.
    - If you are replacing an RDX drive and are instructed to return the old RDX drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 163.

Installing or replacing a 2.5-inch solid-state drive

This topic contains the following items:

- "Installing a 2.5-inch solid-state drive into a 3.5-inch hard-disk-drive bay" on page 108
- "Replacing a 2.5-inch solid-state drive from a 3.5-inch hard-disk-drive bay" on page 113

For a list of ThinkServer solid-state drive options, go to:
http://www.lenovo.com/thinkserver

You can install or replace a hot-swap solid-state drive without turning off the server, which helps you avoid significant interruption to the operation of the system.

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. The number of the installed hard disk drives or solid-state drives in your server varies depending on the server model. The vacant bays are occupied by dummy hard-disk-drive trays. When you install a hot-swap hard disk drive or solid-state drive, save the removed dummy hard-disk-drive tray from the drive bay in the event that you later remove the hot-swap hard disk drive or solid-state drive and need the dummy tray to cover the place.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new hot-swap hard disk drive or solid-state drive as soon as you remove the failing one or the dummy tray.

Before you begin, review the following solid-state drive installation rules:

- Follow the order of the hard-disk-drive bays when installing a solid-state drive. See "Server components" on page 23 to locate the hard-disk-drive bays in your server.
- For RAID configuration, the solid-state drives must be the same type with the same capacity if they are within a single RAID array. For more information, see "Configuring RAID" on page 57.
- For solid-state drives with different capacities, install the solid-state drive by following the order of the hard-disk-drive bays as well as the order from the lowest capacity to the highest capacity.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the model, your server might come with 3.5-inch hot-swap hard disk drives or 2.5-inch hot-swap hard disk drives. The illustrations in this topic are based on server models with 3.5-inch hot-swap hard disk drives. For other models, the replacement procedure is similar.
- Depending on the model, your server might look slightly different from the illustrations in this topic.

- Use any documentation that comes with the solid-state drive and follow those instructions in addition to the instructions in this topic.

Installing a 2.5-inch solid-state drive into a 3.5-inch hard-disk-drive bay

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to install a 2.5-inch solid-state drive into a 3.5-inch hard-disk-drive bay.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Ensure that you have a 3.5-inch to 2.5-inch drive adapter and a 3.5-inch drive bracket available before the installation.

To install a 2.5-inch solid-state drive into a 3.5-inch hard-disk-drive bay, do the following:

1. Use the front door key to unlock the front door, and then use the front door handle **1** to pivot the front door to the open position.

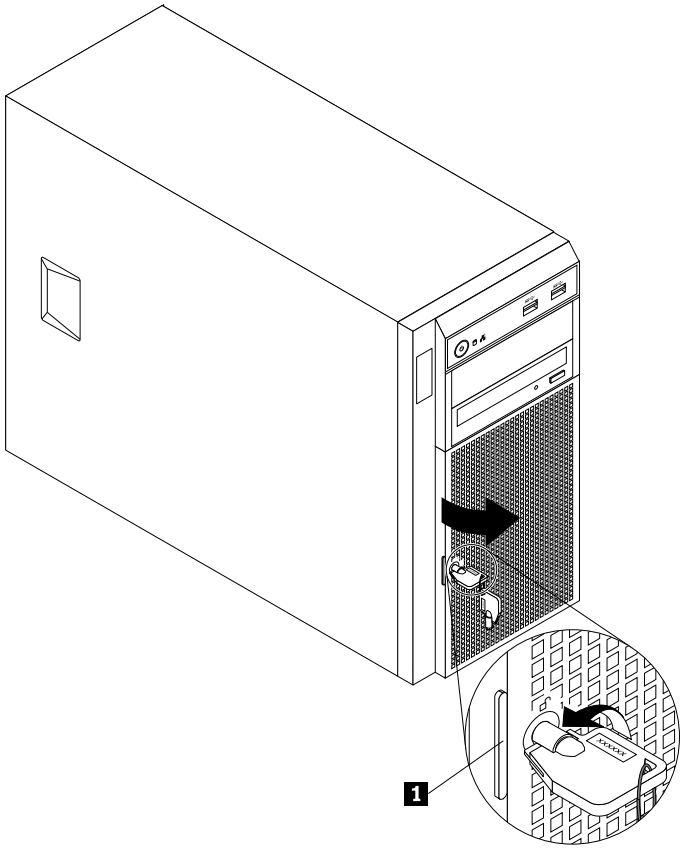


Figure 62. Opening the front door of the server

2. Locate the appropriate hard-disk-drive bay. See “Server components” on page 23.

3. Press the release button **1** to open the handle of the dummy hard-disk-drive tray.

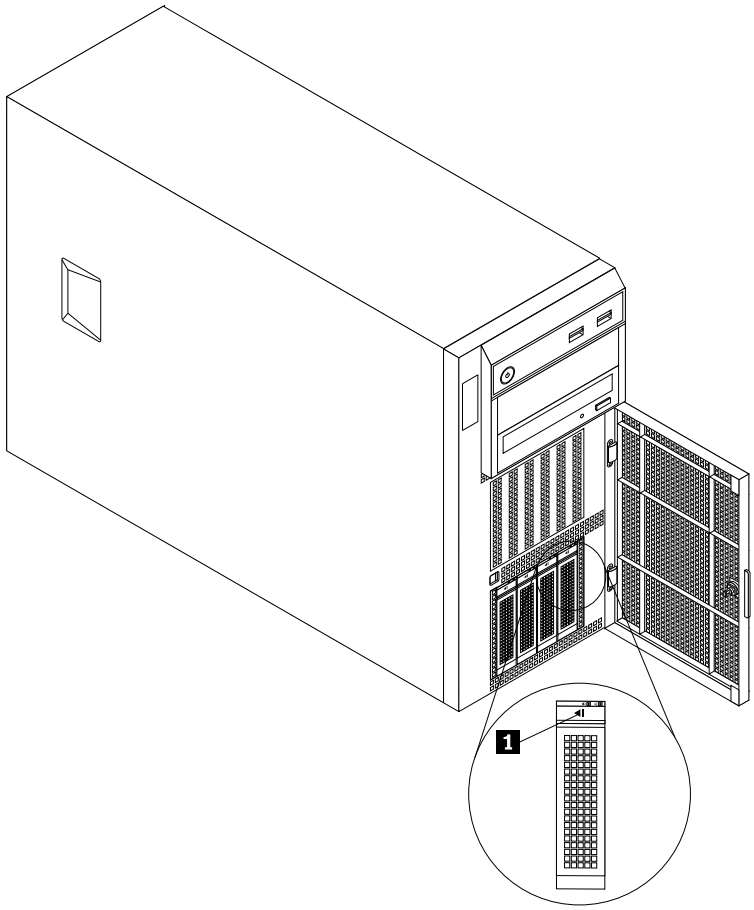


Figure 63. Opening the handle of the dummy hard-disk-drive tray

4. Pull the handle and carefully slide the dummy hard-disk-drive tray out of the front of the chassis.

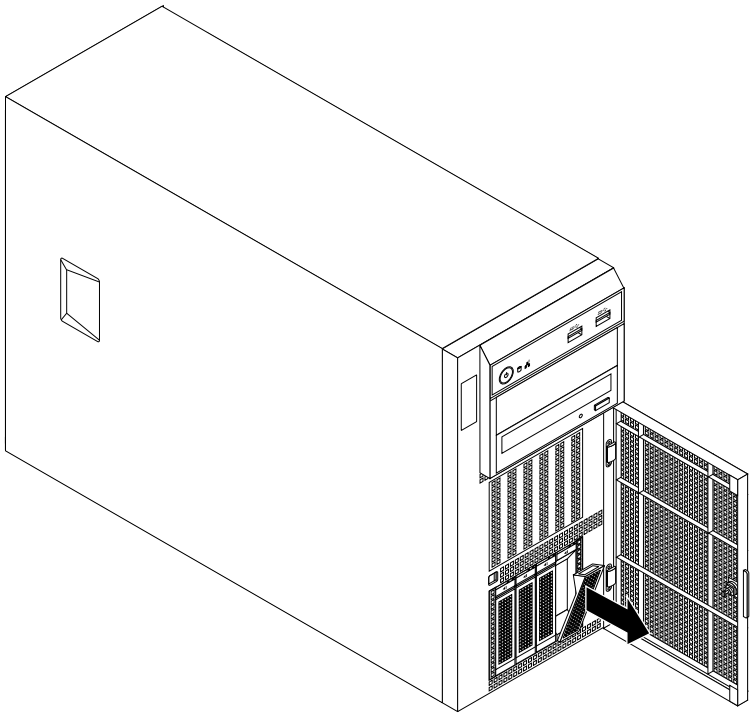


Figure 64. Removing the dummy hard-disk-drive tray

5. Touch the static-protective package that contains the 2.5-inch solid-state drive to any unpainted surface on the outside of the server. Then, take the solid-state drive out of the package.

   Note: Do not touch the circuit board on the solid-state drive.

6. Position the 2.5-inch solid-state drive into the 3.5-inch to 2.5-inch drive adapter as shown in the following illustration.

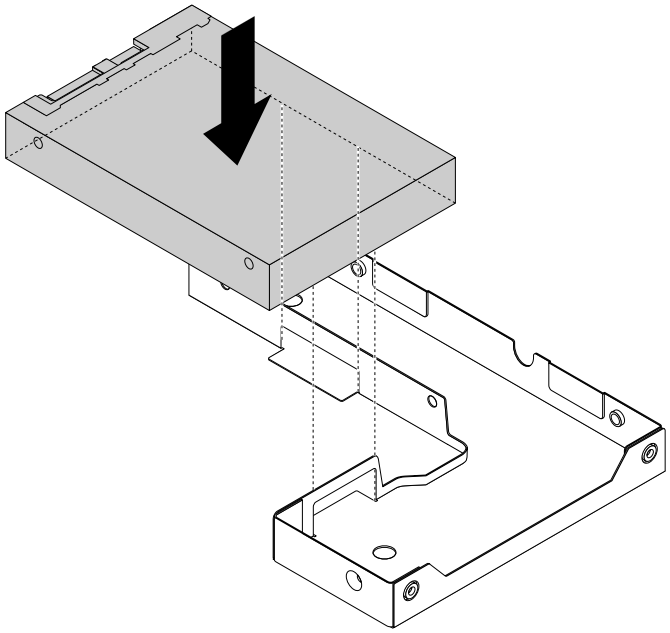


Figure 65. Positioning the 2.5-inch solid-state drive into the drive adapter

7. Align the two screw holes in the solid-state drive with the corresponding holes in the drive adapter. Then, install the two screws to secure the solid-state drive to the drive adapter.

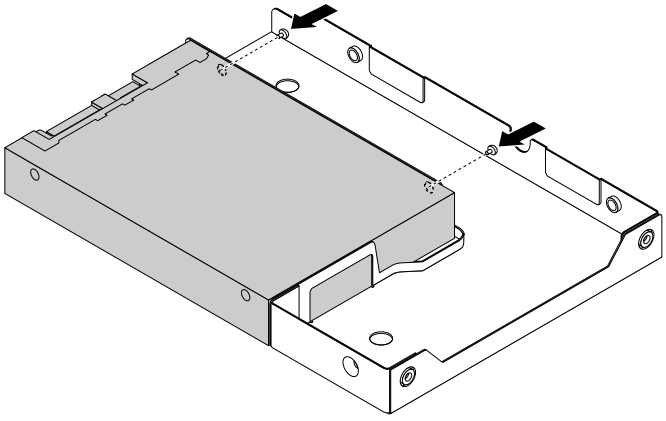


Figure 66. Installing the screws to secure the solid-state drive to the drive adapter

8. Position the drive adapter and the solid-state drive into the 3.5-inch drive bracket. Align the screw holes in the drive adapter and the solid-state drive with the corresponding holes in the bracket. Then, install the five screws to secure the drive adapter and the solid-state drive into the bracket.

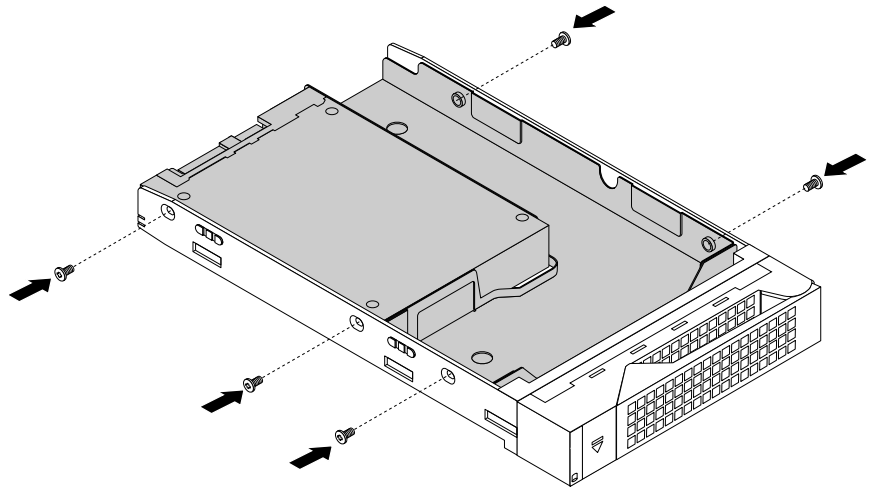


Figure 67. Installing the screws to secure the drive adapter and the solid-state drive to the bracket

9. Slide the bracket with the solid-state drive into the drive bay from the front until it snaps into position and then completely close the handle.

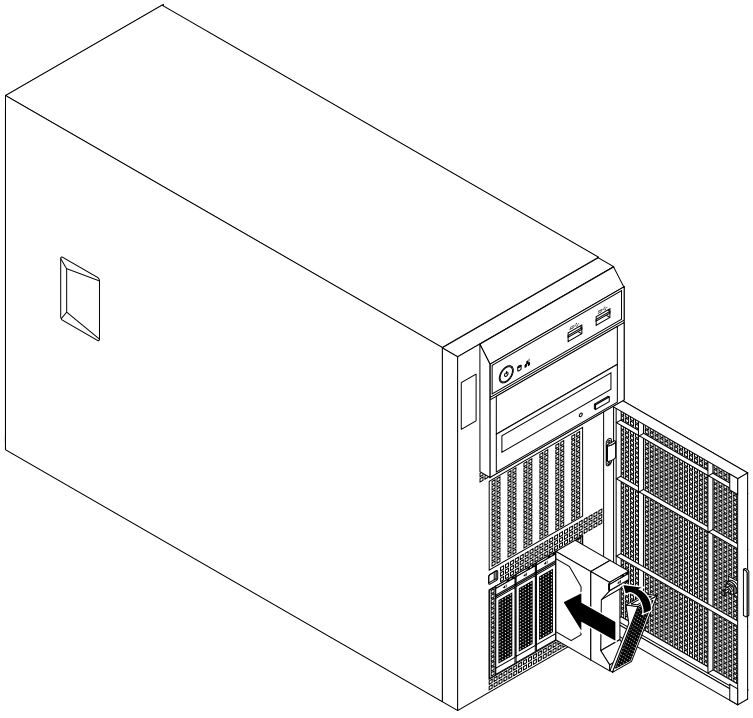


Figure 68. Installing the bracket with the solid-state drive

10. Check the hard-disk-drive status LEDs to ensure that the solid-state drive is operating correctly. You might have to restart the server for the newly installed solid-state drive to be recognized. See “Hot-swap

hard-disk-drive status LEDs" on page 28. If the solid-state drive is faulty, reinstall or replace it until it is operating correctly.

11. Save the removed dummy hard-disk-drive tray in the event that you later remove the solid-state drive and need a dummy tray to cover the drive bay.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To configure RAID, go to "Configuring RAID" on page 57.
- To complete the installation, go to "Completing the parts replacement" on page 163.

Replacing a 2.5-inch solid-state drive from a 3.5-inch hard-disk-drive bay

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to replace a 2.5-inch solid-state drive from a 3.5-inch hard-disk-drive bay.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

To replace a 2.5-inch solid-state drive, do the following:

1. Use the front door key to unlock the front door, and then use the front door handle **1** to pivot the front door to the open position.

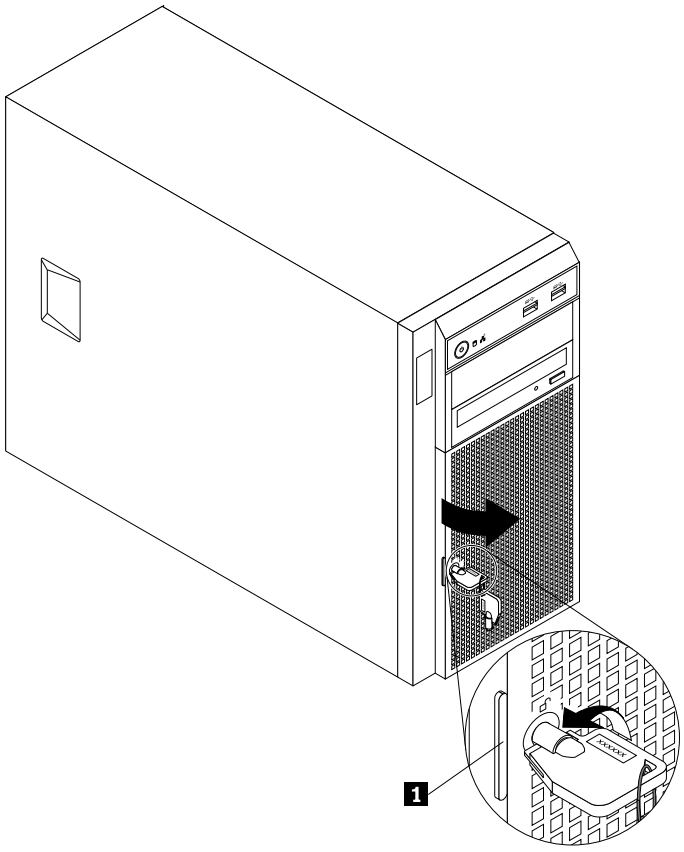


Figure 69. Opening the front door of the server

2. Locate the appropriate hard-disk-drive bay. See “Server components” on page 23.

3. Press the release button **1** to open the handle of the 3.5-inch drive bracket.

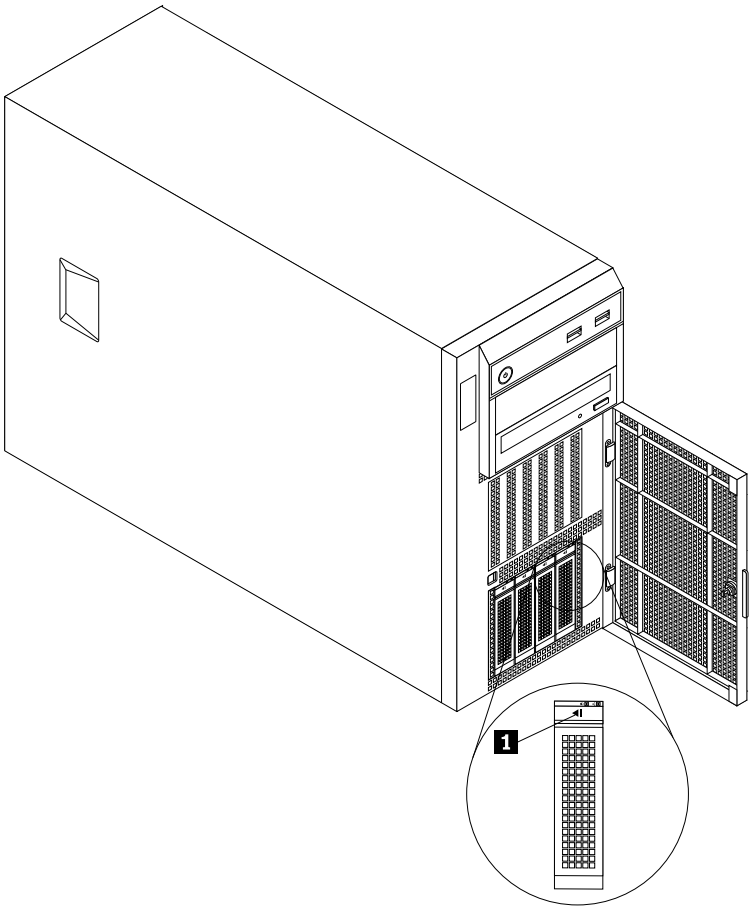


Figure 70. Opening the handle of the 3.5-inch drive bracket

4. Pull the handle and carefully slide the bracket with the solid-state drive out of the front of the chassis.

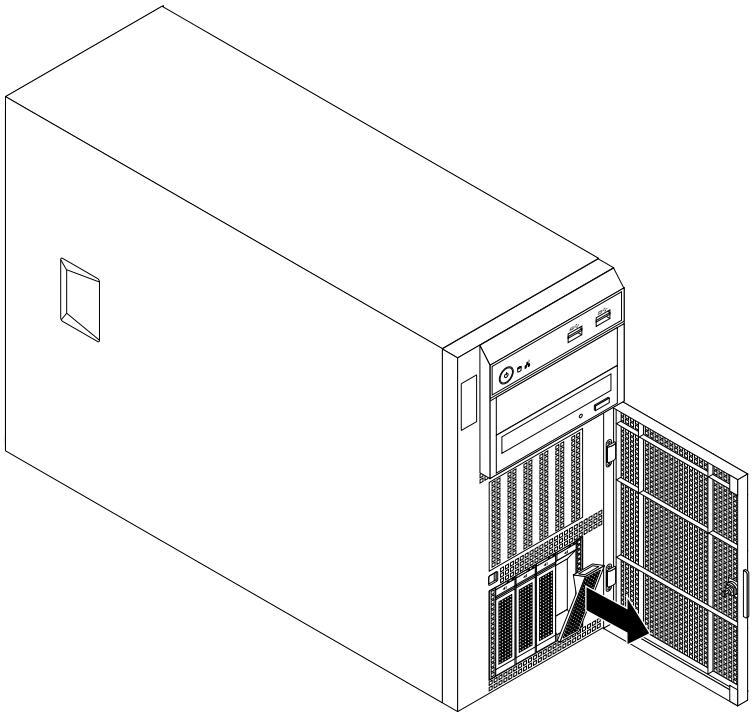


Figure 71. Removing the bracket with the solid-state drive

5. Remove the five screws that secure the solid-state drive and the drive adapter. Then, remove the solid-state drive and the drive adapter from the bracket.

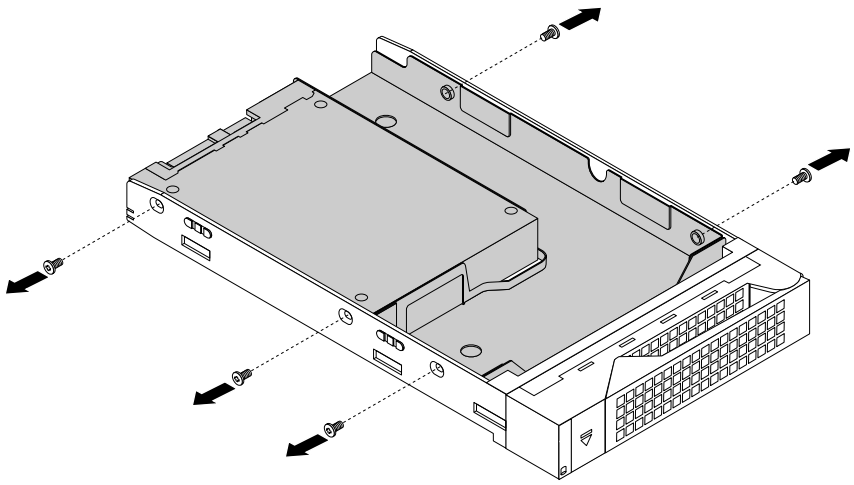


Figure 72. Removing the screws that secure the solid-state drive and the drive adapter

6. Remove the two screws that secure the solid-state drive.

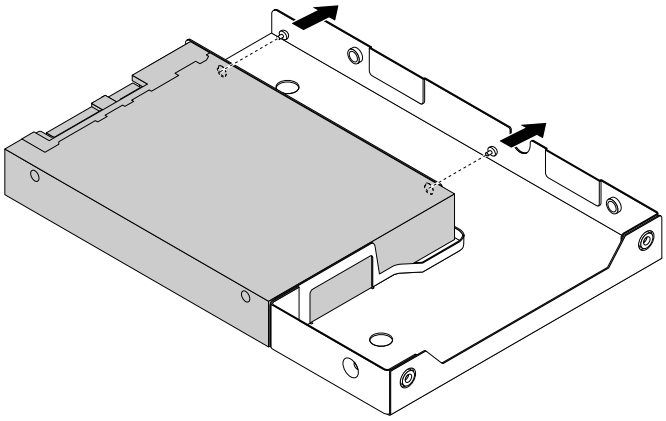


Figure 73. Removing the screws that secure the solid-state drive

7. Lift the solid-state drive up to remove it from the drive adapter.

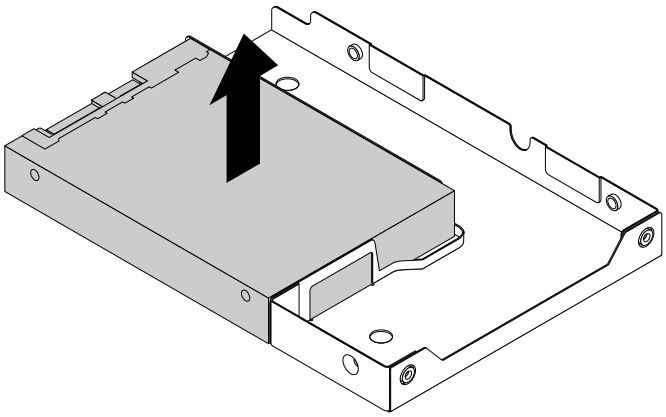


Figure 74. Removing the solid-state drive from the drive adapter

8. Install a new solid-state drive. See “Installing a 2.5-inch solid-state drive into a 3.5-inch hard-disk-drive bay” on page 108.
9. If you are instructed to return the old solid-state drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To configure RAID, go to “Configuring RAID” on page 57.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Installing or replacing a hot-swap hard disk drive

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to install or replace a hot-swap hard disk drive.

This topic applies only to server models that have hot-swap hard disk drives installed. See “Features” on page 7 for more information about the supported hot-swap hard disk drives.

For a list of ThinkServer hard-disk-drive options, go to:
http://www.lenovo.com/thinkserver

You can install or replace a hot-swap hard disk drive without turning off the server, which helps you avoid significant interruption to the operation of the system.

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. The number of the installed hard disk drives in your server varies depending on the server model. The vacant bays are either covered by an EMI-protective panel or occupied by dummy hard-disk-drive trays. When you install a hot-swap hard disk drive, save the removed dummy hard-disk-drive tray from the drive bay in case you later remove the hot-swap hard disk drive and need the dummy tray to cover the place.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new hot-swap hard disk drive as soon as you remove the failing one or the dummy tray.

Before you begin, review the following hard-disk-drive installation rules:

- Follow the order of the hard-disk-drive bays when installing a hard disk drive. See “Server components” on page 23 to locate the hard-disk-drive bays in your server.
- For RAID configuration, the hard disk drives must be the same type with the same capacity if they are within a single RAID array. For more information, see “Configuring RAID” on page 57.
- For hard disk drives with different capacities, install the hard disk drive by following the order of the hard-disk-drive bays as well as the order from the lowest capacity to the highest capacity.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the model, your server might come with 3.5-inch hot-swap hard disk drives or 2.5-inch hot-swap hard disk drives. The illustrations in this topic are based on server models with four 3.5-inch hot-swap SATA or SAS hard disk drives. For other models, the replacement procedure is similar.
- Depending on the model, your server might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the hot-swap hard disk drive and follow those instructions in addition to the instructions in this topic.

To install or replace a hot-swap hard disk drive, do the following:

1. Use the front door key to unlock the front door, and then use the front door handle **1** to pivot the front door to the open position.

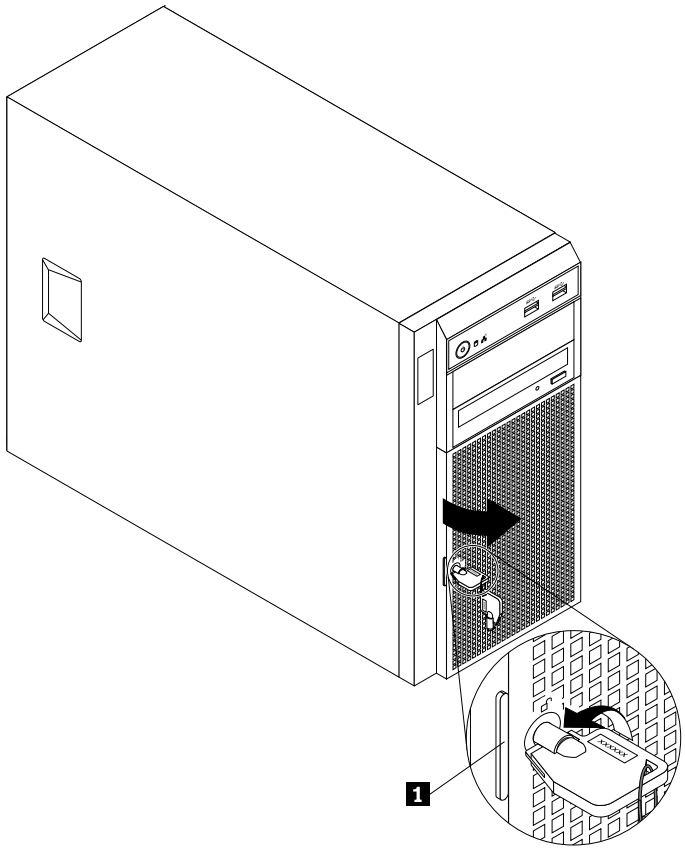


Figure 75. Opening the front door of the server

2. Locate the hard-disk-drive bay. See “Server components” on page 23.

3. Press the release button **1** to open the handle of the hot-swap hard disk drive or the dummy tray.

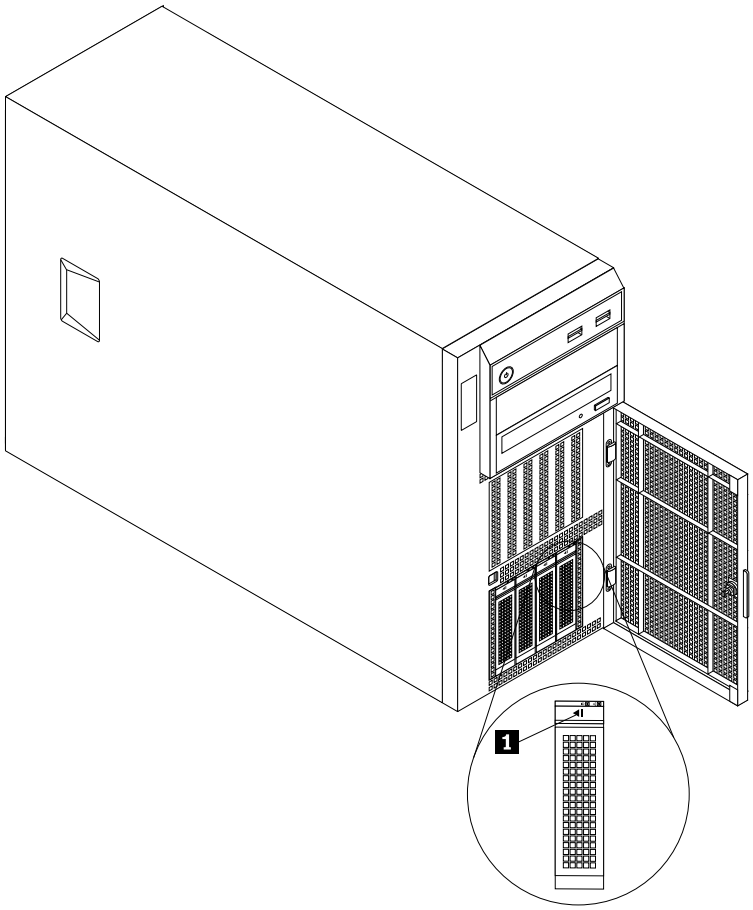


Figure 76. Opening the handle of the hot-swap hard disk drive or the dummy tray

4. Pull the handle and carefully slide the hot-swap hard disk drive or the dummy tray out of the front of the chassis.

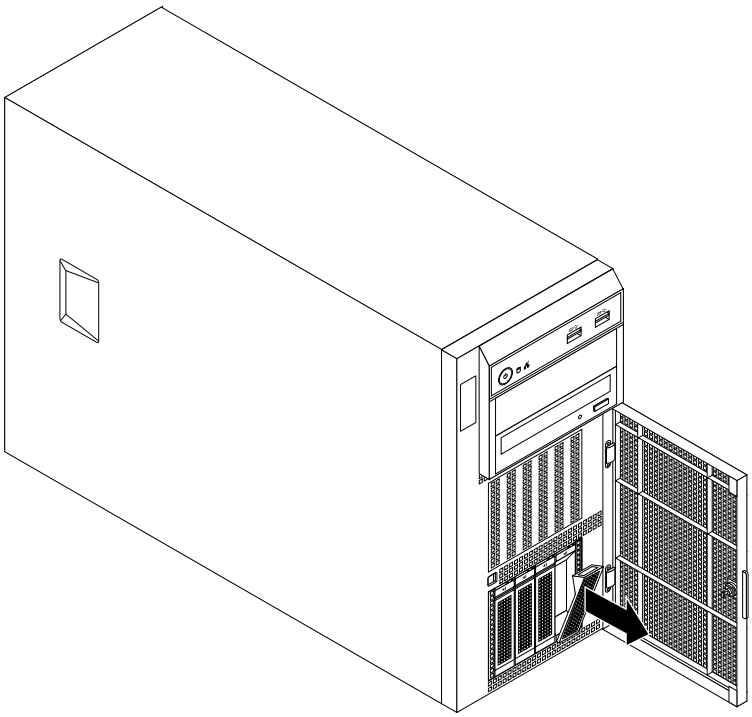


Figure 77. Removing the hot-swap hard disk drive or the dummy tray

5. Touch the static-protective package that contains the new hot-swap hard disk drive to any unpainted surface on the outside of the server. Then, take the new hot-swap hard disk drive out of the package.

   Note: Do not touch the circuit board on the hard disk drive.

6. Slide the new hot-swap hard disk drive into the drive bay from the front until it snaps into position, and then completely close the handle.

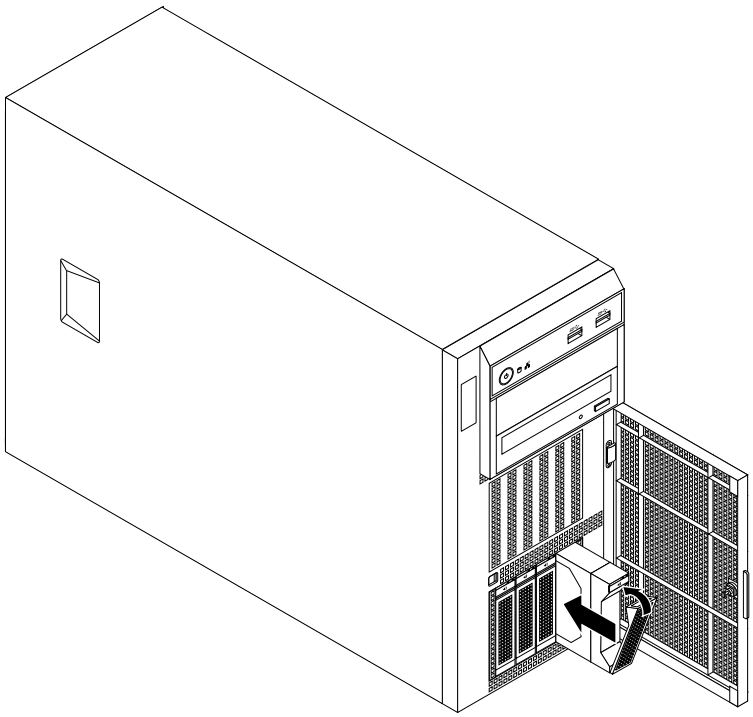


Figure 78. Installing the hot-swap hard disk drive

7. Check the hot-swap hard-disk-drive status LEDs to ensure that the hard disk drive is operating correctly. You might have to restart the server for the newly installed hard disk drive to be recognized. See "Hot-swap hard-disk-drive status LEDs" on page 28. If the hard disk drive is faulty, you need to reinstall or replace it until it is operating correctly.
8. Close and lock the front door.
9. Do one of the following:
   - If you are installing a hot-swap hard disk drive, save the removed hard-disk-drive dummy tray in case you later remove the hot-swap hard disk drive and need a dummy tray to cover the drive bay.
   - If you are replacing a hot-swap hard disk drive and are instructed to return the old hot-swap hard disk drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To configure RAID, go to "Configuring RAID" on page 57.

Installing or replacing a hot-swap redundant power supply

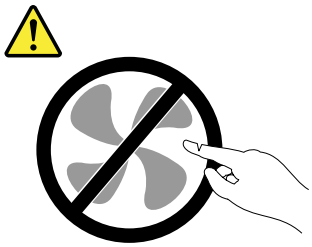
Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to install or replace a hot-swap redundant power supply. This topic applies only to server models that come with one or two hot-swap redundant power supplies.

The hot-swap redundant power supply adds a second source of power to the server. When the server is populated with two hot-swap redundant power supplies, it can withstand a power loss from either power supply. This helps you avoid significant interruption to the operation of the server when a power supply fails. You can replace the failing hot-swap redundant power supply without turning off the server.

Some server models come with only one power supply. You can purchase a hot-swap redundant power supply option from Lenovo.

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- To maintain the EMI integrity and cooling of the server, install a new hot-swap redundant power supply as soon as you remove the failing one or cover the other bay with a shield if you use one power supply to provide power.
- Your hot-swap redundant power supply might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the new hot-swap redundant power supply and follow those instructions in addition to the instructions in this topic.

To install or replace a hot-swap redundant power supply, do the following:

1. Do one of the following:
   - If you are installing a hot-swap redundant power supply, locate the bay for the power supply in the rear of your server. Press the small tab on the metal shield in the direction as shown and pull the tab at the same time to remove the shield out of the chassis. Store the shield in case you later remove the power supply and need the shield to cover the bay.

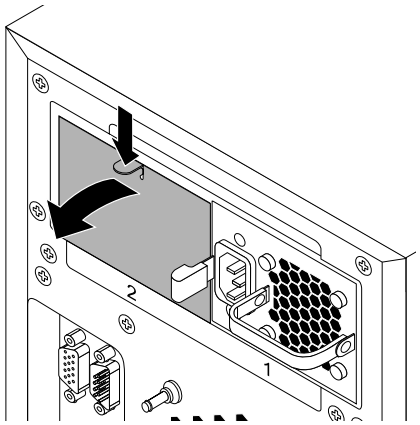


Figure 79. Removing the protective shield for the power supply bay

   - If you are replacing a hot-swap redundant power supply, locate the failing power supply in the rear of your server, and then disconnect the power cord from the failing hot-swap redundant power supply.

     Note: On each hot-swap redundant power supply, there is a status LED near the power cord connector. When the LED is lit in green, it indicates that the hot-swap redundant power supply is working correctly. When the LED is lit in amber, it indicates that the hot-swap redundant power supply is likely to fail or has failed.

2. If you are replacing a hot-swap redundant power supply, press the release tab **1** in the direction as shown and carefully pull the handle **2** at the same time to slide the failing hot-swap redundant power supply out of the chassis.

   Note: Do not use too much strength. You can first carefully slide the redundant power supply a little bit out to release it from the secured position. Then, completely slide it out of the chassis.

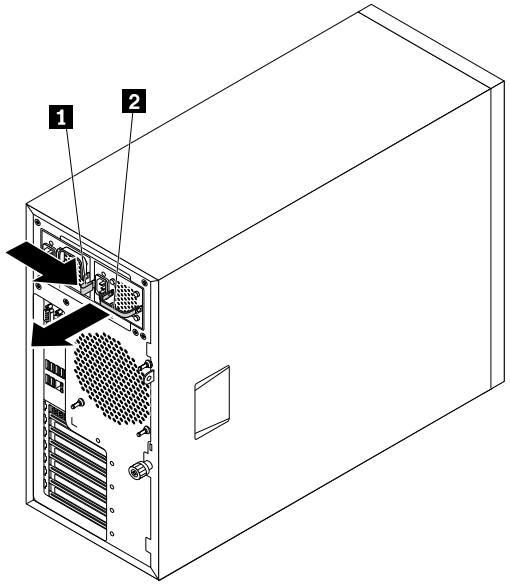


Figure 80. Removing a hot-swap redundant power supply

3. Touch the static-protective package that contains the new hot-swap redundant power supply to any unpainted surface on the outside of the server. Then, remove the new hot-swap redundant power supply from the package.

4. Note the orientation of the hot-swap redundant power supply, and then slide it into the chassis until it snaps into position.

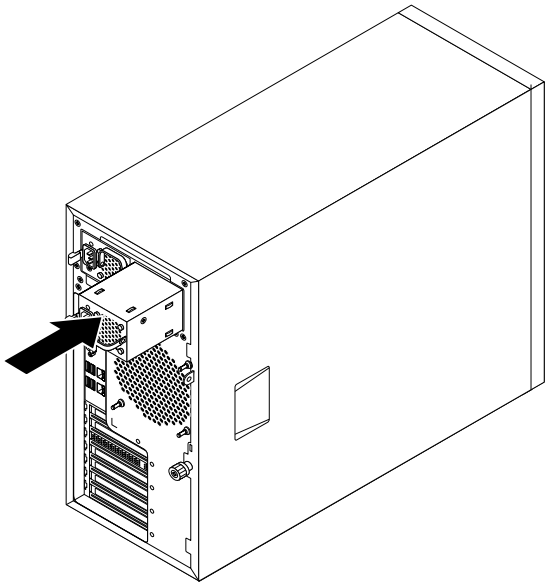


Figure 81. Installing a hot-swap redundant power supply

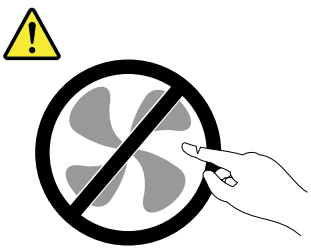
5. Connect the power cord to the power cord connector on the new hot-swap redundant power supply. Then, check the status LED near the power cord connector. When the LED is lit in green, it indicates that the hot-swap redundant power supply is working correctly. When the LED is lit in amber, it indicates that the hot-swap redundant power supply is likely to fail or has failed. Reinstall the new hot-swap redundant power supply to see if the problem can be solved. If the new hot-swap redundant power supply still does not work correctly, contact your place of purchase or a service representative for help.
6. If you are instructed to return the old hot-swap redundant power supply, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Replacing the power distribution board and cage assembly

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the power distribution board and cage assembly. This topic applies only to server models that come with hot-swap redundant power supplies.

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the power distribution board and cage assembly, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the hot-swap redundant power supplies. See “Installing or replacing a hot-swap redundant power supply” on page 122.

   Note: If your server comes with one hot-swap redundant power supply installed in the redundant power supply bay 1 (the bay number is marked on the rear of the chassis), there is a shied installed on bay 2 to protect the empty bay. Remove the shield and save it for future use.
3. Remove the server cover. See “Removing the server cover” on page 67.
4. Lay the server on its side for easier operation.
5. Remove the front system fans. See “Replacing the front system fan 1” on page 144.
6. Record the cable routing and connection. Then, disconnect the power cables of the power distribution board and cage assembly from the system board and or the power conversion board.
7. Release the power cables of the power distribution board and cage assembly from the cable clips and ties in the chassis.

8. Remove the four screws **1** at the rear of the chassis and the two screws **2** on the metal clip at the front of the power distribution board and cage assembly. Then, push the power distribution board and cage assembly from the rear until it is released from the metal retaining tab **3**. Then, carefully lift the power distribution board and cage assembly out of the chassis.

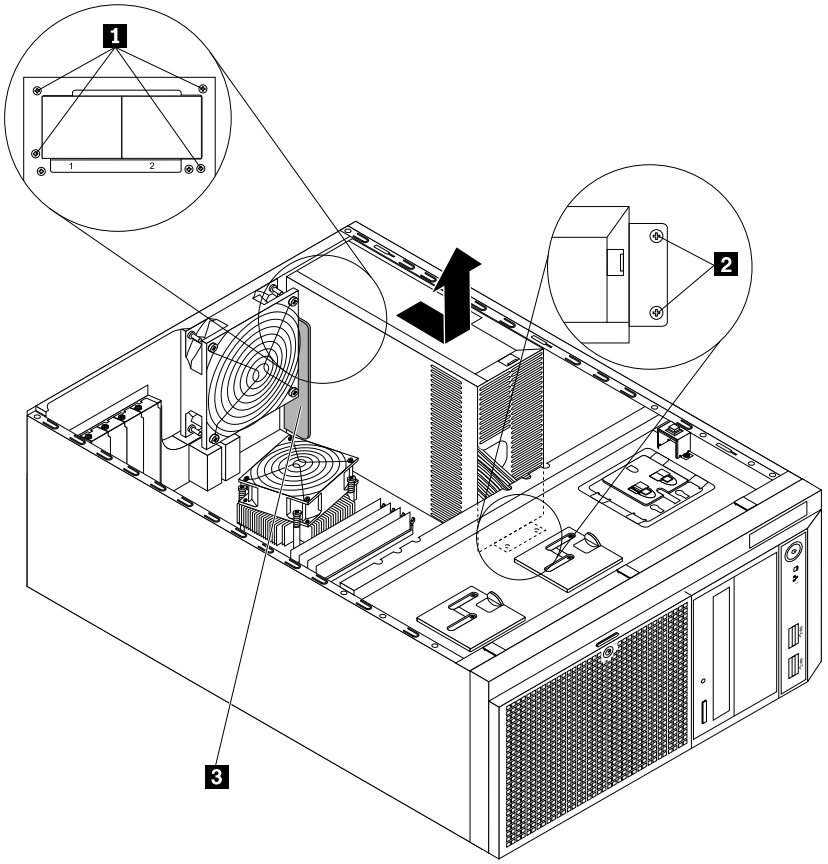


Figure 82. Removing the power distribution board and cage assembly

9. Touch the static-protective package that contains the new power distribution board and cage assembly to any unpainted surface on the outside of the server. Then, remove the new power distribution board and cage assembly from the package.

10. Install the new power distribution board and cage assembly into the chassis. Ensure that the four screw holes **1** in the rear of the new power distribution board and cage assembly are aligned with the corresponding holes marked with R in the rear of the chassis. Meanwhile, ensure that the two screw holes **2** in the metal clip at the front of the new power distribution board and cage assembly are aligned with the corresponding holes in the chassis. Then, install all the screws to secure the new power distribution board and cage assembly in place.

    Note: Use only screws provided by Lenovo.

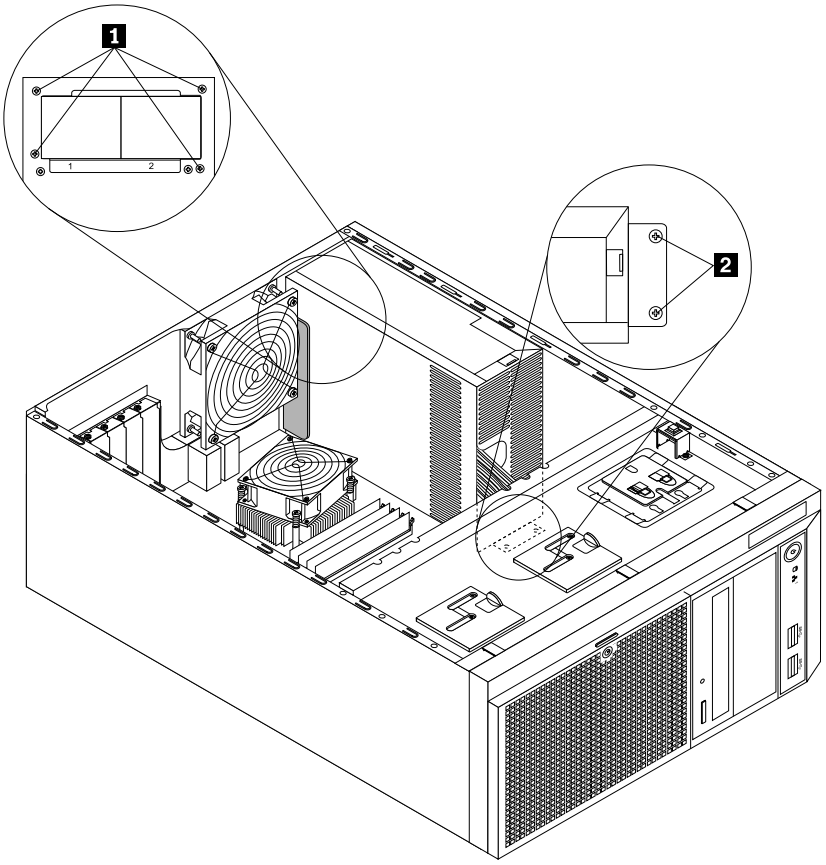


Figure 83. Installing the power distribution board and cage assembly

11. Refer to your note to connect the power cables of the new power distribution board and cage assembly to the system board and or power conversion board, depending on the model. Then, correctly route the cables and secure the cables with the cable clips and ties in the chassis.
12. Reinstall the front system fans. See “Replacing the front system fan 1” on page 144.
13. Reinstall the hot-swap redundant power supplies and the protective shield for the redundant power supply bay 2 if necessary. See “Installing or replacing a hot-swap redundant power supply” on page 122.
14. If you are instructed to return the old power distribution board and cage assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the power conversion board

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the power conversion board. This topic applies only to server models that come with a RAID card installed.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the power conversion board, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Locate the power conversion board. See “Server components” on page 23.
4. Record the cable routing and connection. Then, disconnect the power cables from the power conversion board.

5. Remove the screw that secures the power conversion board. Then, slide the power conversion board to the front of the chassis until it is released from the retention posts on the chassis, and then carefully remove the board out of the chassis.

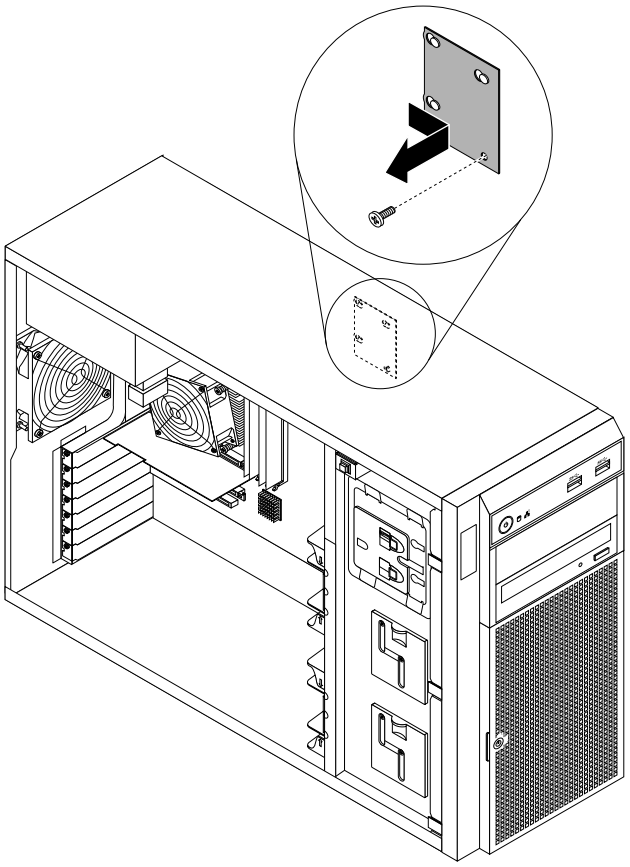


Figure 84. Removing the power conversion board

6. Touch the static-protective package that contains the new power conversion board to any unpainted surface on the outside of the server. Then, remove the new power conversion board from the package.

   Note: Carefully handle the power conversion board by its edges.

7. Position the new power conversion board into the chassis so that the three retention posts 1 on the chassis pass through the corresponding holes in the power conversion board. Then, slide the new power conversion board to the rear of the chassis until the power conversion board is securely seated. Ensure that the screw hole in the new power conversion board is aligned with the mounting stud 2 on the chassis. Then, install the screw to secure the new power conversion board in place.

   Note: Use only screws provided by Lenovo.

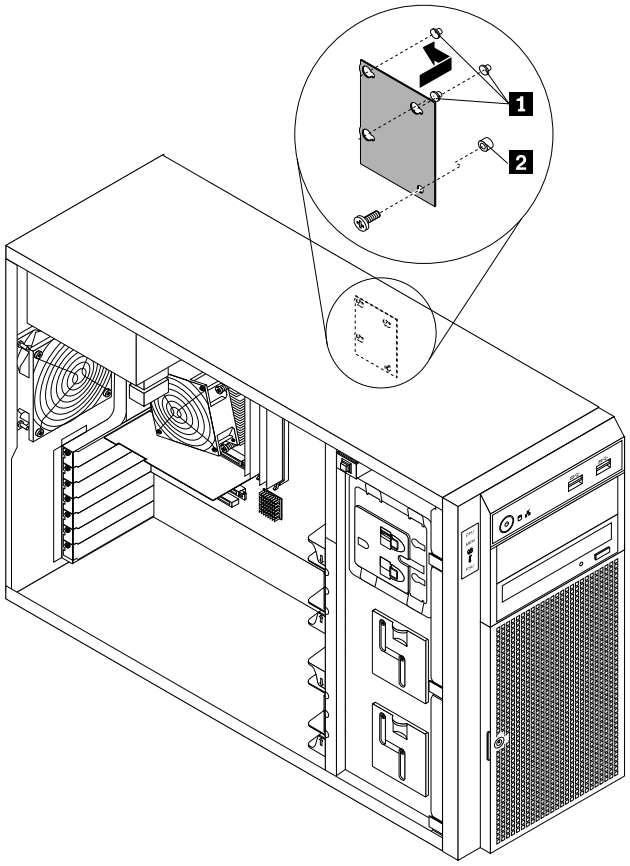


Figure 85. Installing the power conversion board

8. Refer to your note to connect the power cables to the new power conversion board.
9. If you are instructed to return the old power conversion board, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the hot-swap hard-disk-drive backplane

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the hot-swap hard-disk-drive backplane. This topic applies only to server models that have hot-swap hard disk drives installed.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- The hot-swap hard-disk-drive backplane is sensitive to ESD. Ensure that you read and understand "Handling static-sensitive devices" on page 66 first and carefully perform the operation.
- Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the hot-swap hard-disk-drive backplane, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See "Removing the server cover" on page 67.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 69.
4. Locate the hot-swap hard-disk-drive backplanes. See "Hot-swap hard-disk-drive backplane" on page 32.
5. Remove the front system fan 1. See "Replacing the front system fan 1" on page 144.
6. Remove all the installed hot-swap hard disk drives and dummy trays (if any) from the hard-disk-drive cage. See "Installing or replacing a hot-swap hard disk drive" on page 117.
7. Record the cable connections on the backplane, and then disconnect all the cables from the backplane.
8. Lift the release latch **1** and slide the hard-disk-drive cage out of the front of the chassis.

   Note: The following illustration shows the 3.5-inch hard-disk-drive cage. For the 2.5-inch hard-disk-drive cage, the removal procedure is the same.

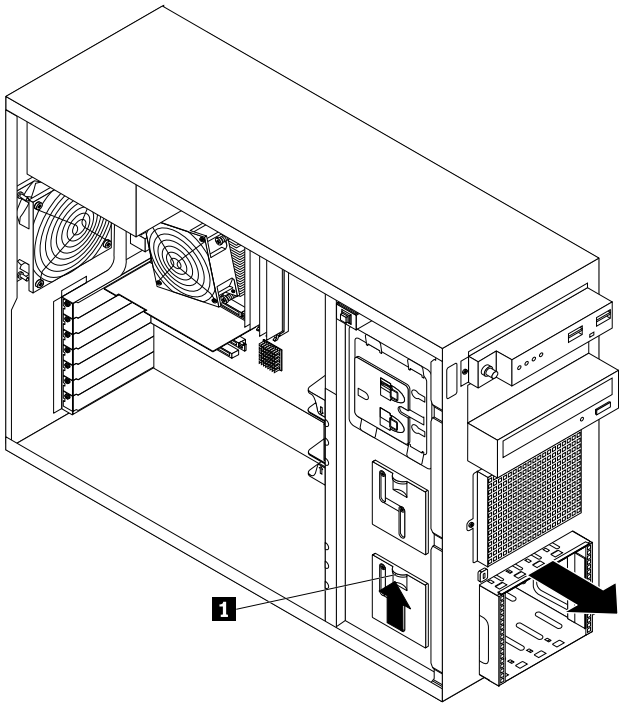


Figure 86. Removing the hard-disk-drive cage

9. Do one of the following:
   - For the backplane for server models with 3.5-inch hard-disk-drive bays, remove the four screws that secure the backplane, and then remove the backplane from the hard-disk-drive cage.

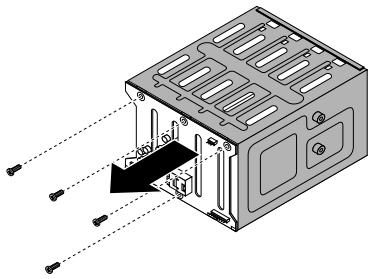


Figure 87. Removing the backplane for server models with 3.5-inch hard-disk-drive bays

   - For the backplane for server models with 2.5-inch hard-disk-drive bays, remove the six screws or three screws that secure the backplane depending on the type of the backplane. Then, remove the backplane from the hard-disk-drive cage.

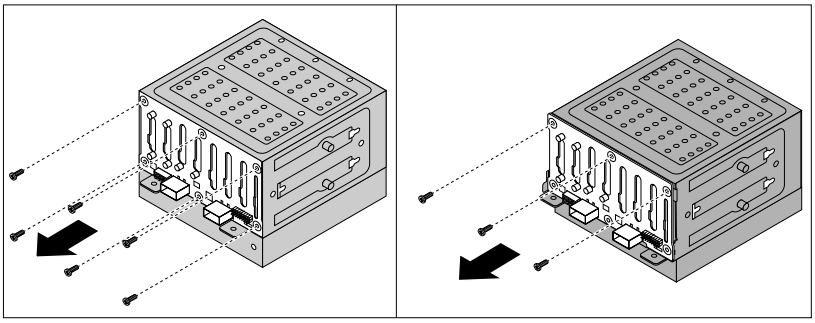


Figure 88. Removing the backplane for server models with 2.5-inch hard-disk-drive bays

10. Touch the static-protective package that contains the new hot-swap hard-disk-drive backplane to any unpainted surface on the outside of the server. Then, remove the new backplane from the package.

    Note: Carefully handle the backplane by its edges.

11. Position the new backplane on the hard-disk-drive cage so that the screw holes in the new backplane are aligned with the corresponding holes in the hard-disk-drive cage. Then, do one of the following depending on the hard-disk-drive cage:

- For the 3.5-inch hot-swap hard-disk-drive cage, install the four screws to secure the backplane on the cage.

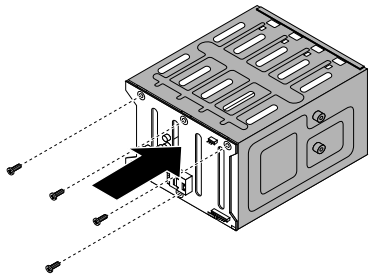


Figure 89. Installing the backplane for server models with 3.5-inch hard-disk-drive bays

- For the 2.5-inch hot-swap hard-disk-drive cage, install the six screws to secure the backplane on the cage.

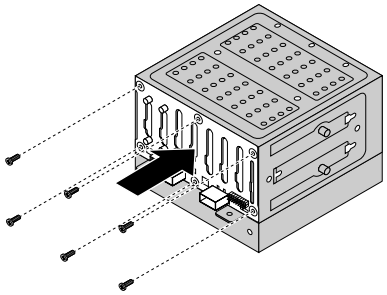


Figure 90. Installing the backplane for server models with 2.5-inch hard-disk-drive bays

Note: If you want to install the following backplane for server models with 2.5-inch hard-disk-drive bays, ensure that the backplane is secured by the two tabs **1**. Then, install the three screws to secure the backplane on the cage.

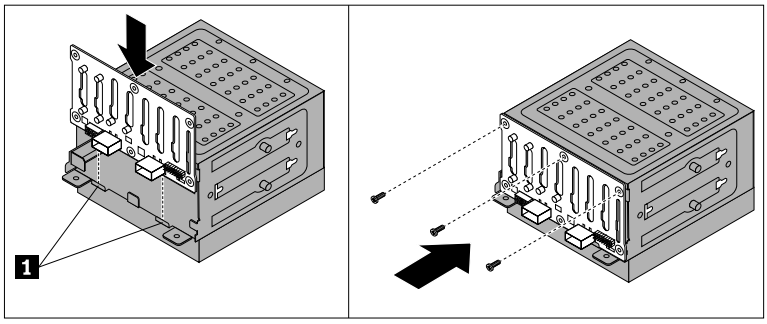


Figure 91. Installing the backplane for server models with 2.5-inch hard-disk-drive bays

12. Slide the hard-disk-drive cage into the chassis from the front until it snaps into position.

    Note: The following illustration shows the 3.5-inch hard-disk-drive cage. For the 2.5-inch hard-disk-drive cage, the installation procedure is the same.

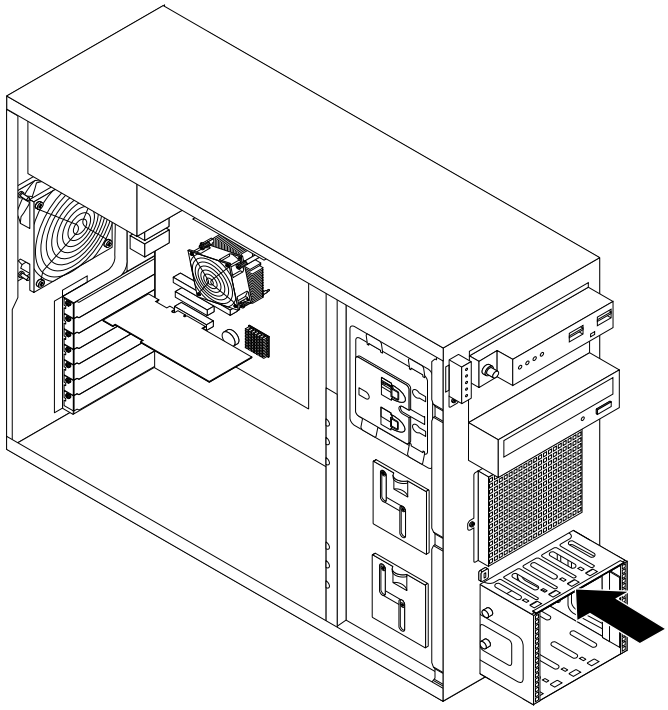


Figure 92. Installing the hard-disk-drive cage

13. Reinstall all the hot-swap hard disk drives and dummy trays (if any) in the hard-disk-drive cage. See "Installing or replacing a hot-swap hard disk drive" on page 117.
14. Refer to your note to reconnect the cables to the backplane.
15. Reinstall the front system fan 1. See "Replacing the front system fan 1" on page 144.
16. Reinstall the front bezel. See "Removing and reinstalling the front bezel" on page 69.
17. If you are instructed to return the old hot-swap hard-disk-drive backplane, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

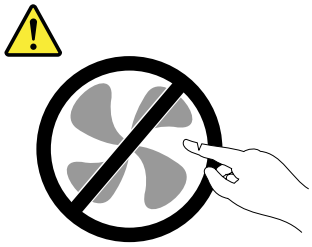
- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to "Completing the parts replacement" on page 163.

Replacing the non-hot-swap power supply assembly

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to replace the non-hot-swap power supply assembly. This topic applies only to server models that come with a non-hot-swap power supply assembly.

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the model, your server might look slightly different from the illustrations in this topic.
- Use any documentation that comes with the new non-hot-swap power supply assembly and follow those instructions in addition to the instructions in this topic.

To replace the non-hot-swap power supply assembly, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the front system fans. See “Replacing the front system fan 1” on page 144.
5. Record the cable routing and connection. Then, disconnect the power supply assembly cables from the system board and or the power conversion board.
6. Release the power supply assembly cables from the cable clips and ties in the chassis.

7. Remove the four screws **1** at the rear of the chassis that secure the power supply assembly, and then push the power supply assembly from the rear until it is released from the metal retaining tab **2**. Then, carefully lift it out of the chassis.

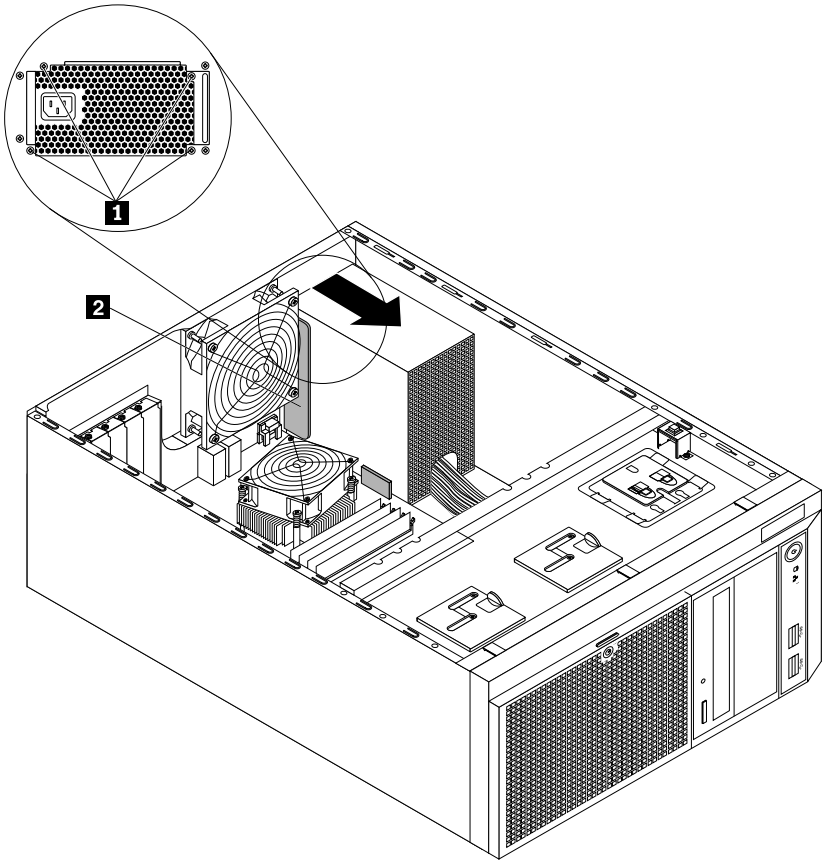


Figure 93. Removing the non-hot-swap power supply assembly

8. Touch the static-protective package that contains the new power supply assembly to any unpainted surface on the outside of the server. Then, remove the new power supply assembly from the package and ensure that the new power supply assembly is the correct replacement. See “Features” on page 7 for information about the supported power supply assembly.

9. Install the new power supply assembly into the chassis so that the four screw holes in the new power supply assembly are aligned with the corresponding holes marked with A in the rear of the chassis. Then, install the four screws **1** to secure the new power supply assembly in place.

   Note: Use only screws provided by Lenovo.

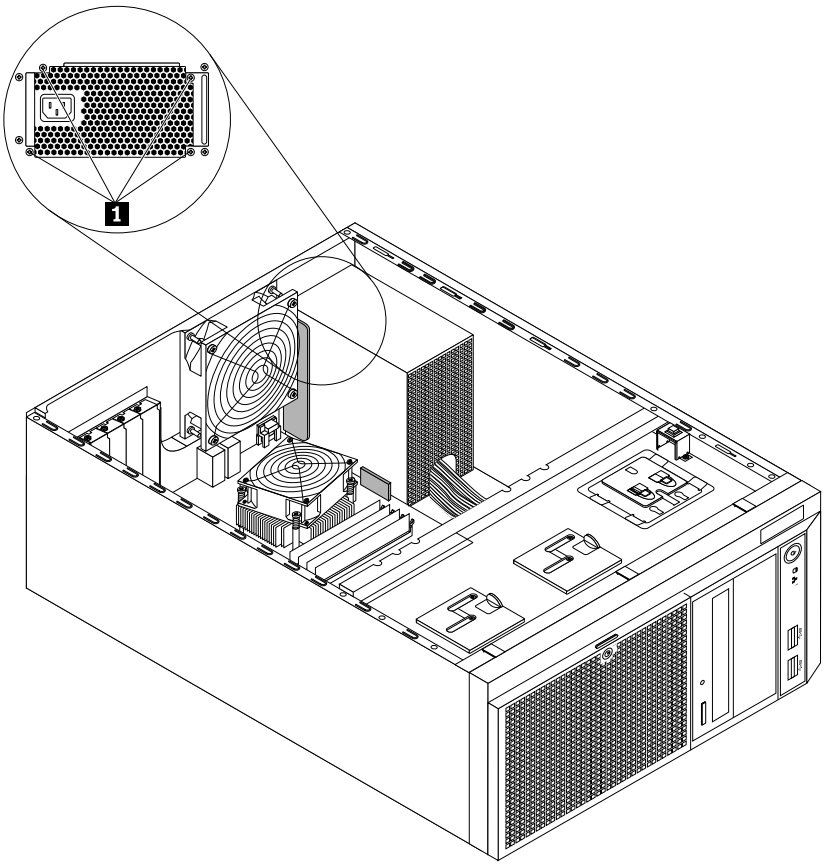


Figure 94. Installing the non-hot-swap power supply assembly

10. Refer to your note to connect the new power supply assembly cables to the system board and or the power conversion board, depending on the model. Then, properly route the cables and secure the cables with the cable clips and ties in the chassis.
11. Reinstall the front system fans. See “Replacing the front system fan 1” on page 144.
12. If you are instructed to return the old non-hot-swap power supply assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the cover presence switch

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This section provides instructions on how to replace the cover presence switch (intrusion switch). This topic applies only to server models that have the cover presence switch installed.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the cover presence switch, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Locate the cover presence switch. See “Server components” on page 23.
4. Disconnect the cable of the cover presence switch from the cover presence switch connector on the system board. See “System board components” on page 39.
5. Remove the screw that secures the cover presence switch assembly. Then, push the cover presence switch assembly to the front of the chassis until it is released from the chassis, and then remove it out of the chassis.

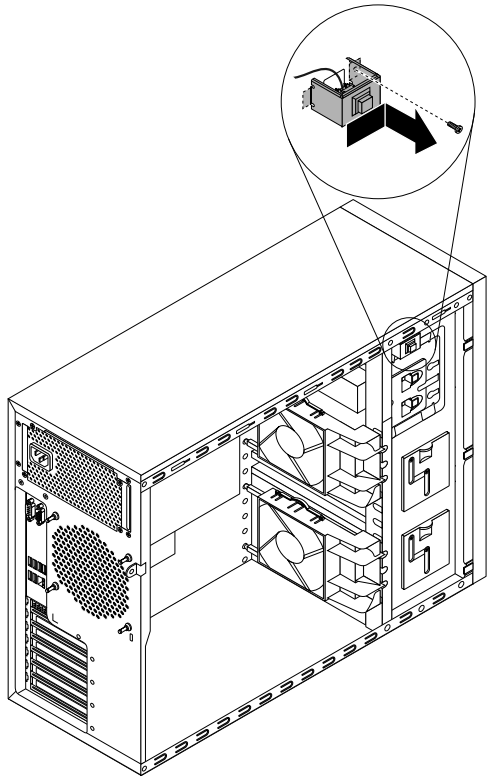


Figure 95. Removing the cover presence switch assembly

6. Press the two tabs on the cover presence switch toward each other and carefully push the cover presence switch upward at the same time to remove it out of the frame.

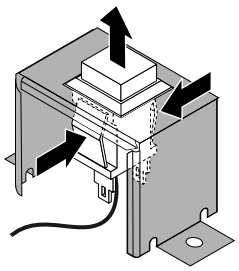


Figure 96. Removing the cover presence switch

7. Touch the static-protective package that contains the new cover presence switch to any unpainted surface on the outside of the server. Then, remove the new cover presence switch from the package.
8. Insert the new cover presence switch with the cable into the cover presence switch frame.

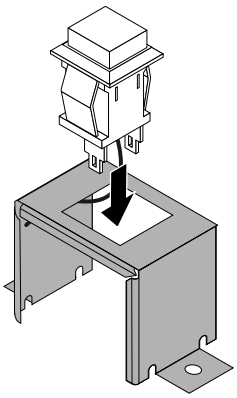


Figure 97. Installing the cover presence switch

9. Insert the tab 1 on the cover presence switch frame into the corresponding hole in the chassis until the frame is securely seated. Ensure that the screw hole in the cover presence switch frame is aligned with the corresponding screw hole in the chassis. Then install the screw to secure the cover presence switch assembly to the chassis.

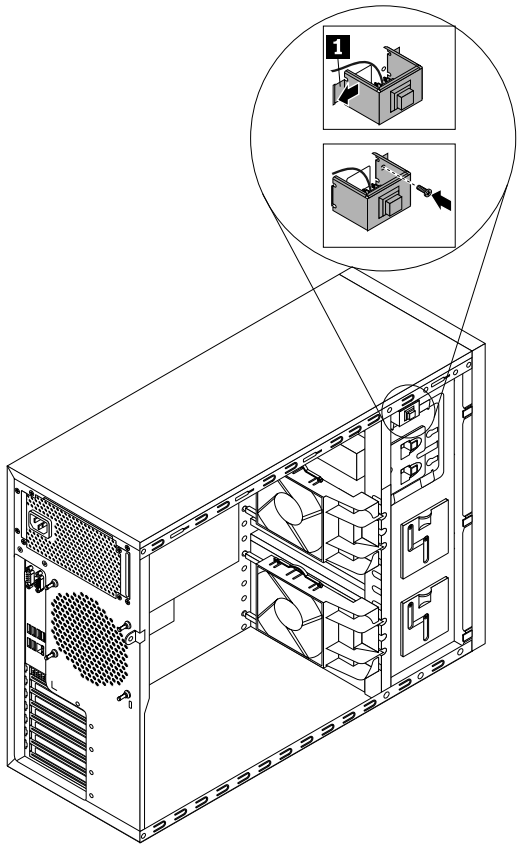


Figure 98. Installing the cover presence switch assembly

10. Connect the cable of the new cover presence switch to the system board. See “System board components” on page 39.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the front panel board assembly

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the front panel board assembly.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Depending on the model, your server might look slightly different from the illustrations in this topic.

- The front panel board assembly is sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 66 first and carefully perform the operation.

To replace the front panel board assembly, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 69.
4. Locate the front panel. See “Front panel” on page 16.
5. Remove the front system fans. See “Replacing the front system fan 1” on page 144.
6. Disconnect the signal cables of the front panel board assembly from the front USB 3.0 connector, the front panel connector, and the thermal sensor connector on the system board. See “System board components” on page 39.
7. If necessary, remove any parts or disconnect any cables that might impede your access to the signal cables of the front panel board assembly. Record the cable routing, and then release the signal cables of the front panel board assembly from any cable clips or ties in the chassis.
8. Remove the screw **1** on the chassis that secures the front panel board assembly. Then, carefully remove the front panel board assembly from the chassis and pull the signal cables of the front panel board assembly out of the chassis.

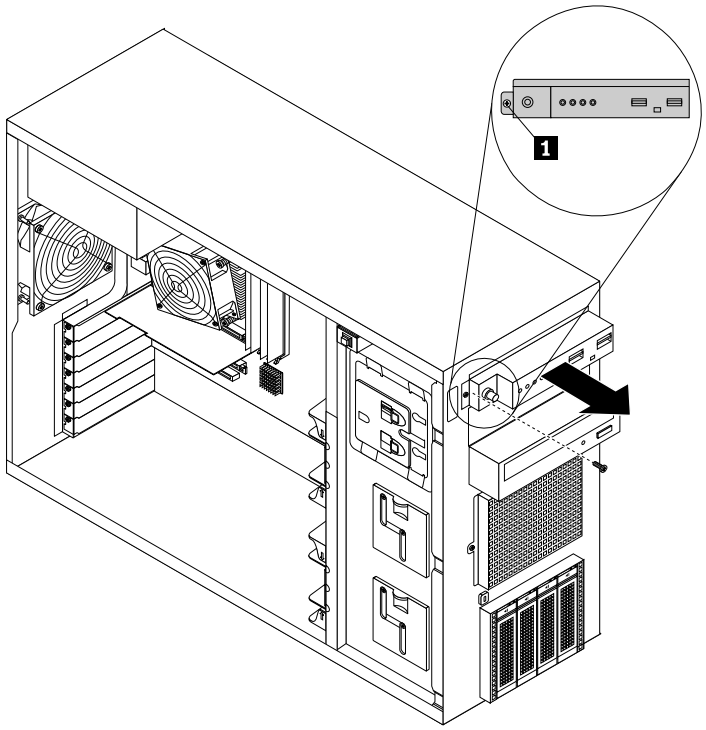


Figure 99. Removing the front panel board assembly

9. Touch the static-protective package that contains the new front panel board assembly to any unpainted surface on the outside of the server. Then, take the new front panel board assembly out of the package.
10. Record the cable connection. Then, disconnect the signal cables from the rear of the old front panel board assembly and connect them to the rear of the new one.

11. Route the signal cables of the new front panel board assembly through the corresponding hole in the chassis and position the new front panel board assembly on the chassis so that the screw hole in it is aligned with the corresponding screw hole **1** in the chassis. Then, install the screw to secure the front panel board assembly in place.

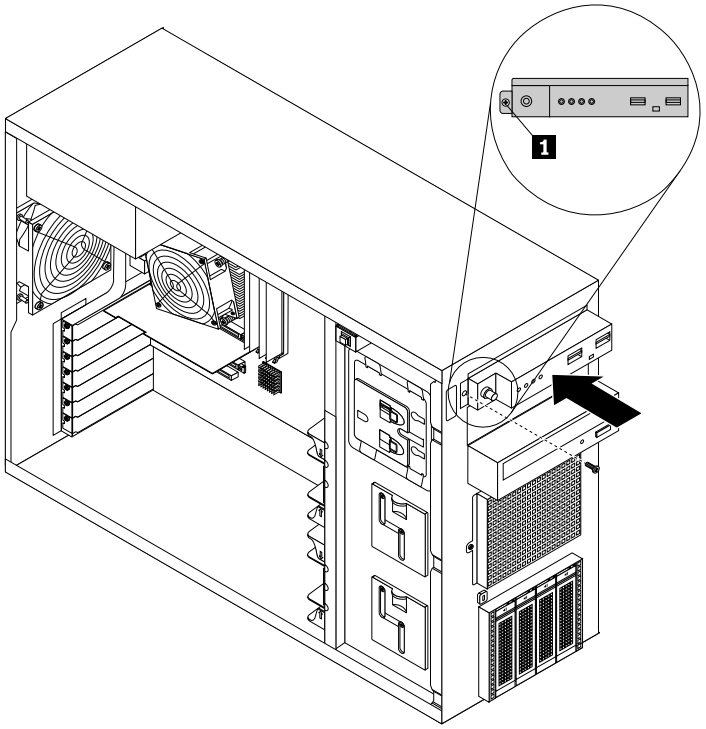


Figure 100. Installing the front panel board assembly

12. Connect the front panel USB cable to the front USB 3.0 connector on the system board. Then, connect the front panel cable to the front panel connector on the system board. See “System board components” on page 39.
13. Refer to your note to properly route the signal cables of the new front panel board assembly. If necessary, secure the signal cables with cable clips or ties in the chassis.
14. Reinstall the front system fans. See “Replacing the front system fan 1” on page 144.
15. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 69.
16. If you are instructed to return the old front panel board assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

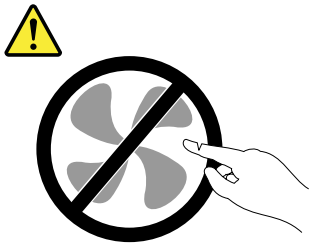
- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the front system fan 1

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the front system fan 1. See “Server components” on page 23 to locate the front system fan 1 installed in your server model.

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the front system fan 1, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Locate the front system fan 1. See “Server components” on page 23.
4. Disconnect the front system fan 1 cable from the system fan 1 connector on the system board. See “System board components” on page 39.
5. Press the two tabs of the front system fan 1 towards each other until the two tips **1** are aligned with the corresponding holes in the chassis. Then, carefully slide the front system fan 1 out of the chassis.

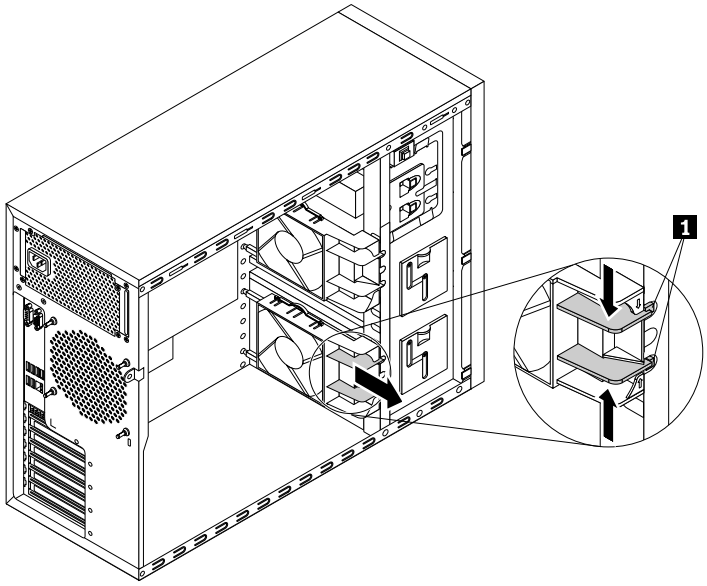


Figure 101. Removing the front system fan 1

6. Touch the static-protective package that contains the new front system fan 1 to any unpainted surface on the outside of the server. Then, remove the new front system fan 1 from the package.

7. Position the new front system fan 1 on the system fan 1 mounting area of the chassis so that the three tips 1 on the bottom of the front system fan 1 are aligned with the corresponding holes in the mounting area. Meanwhile, ensure that the two posts 2 of the front system fan 1 are aligned with the corresponding holes in the inner side of the chassis. Then, carefully slide the front system fan 1 into the chassis until it snaps into position.

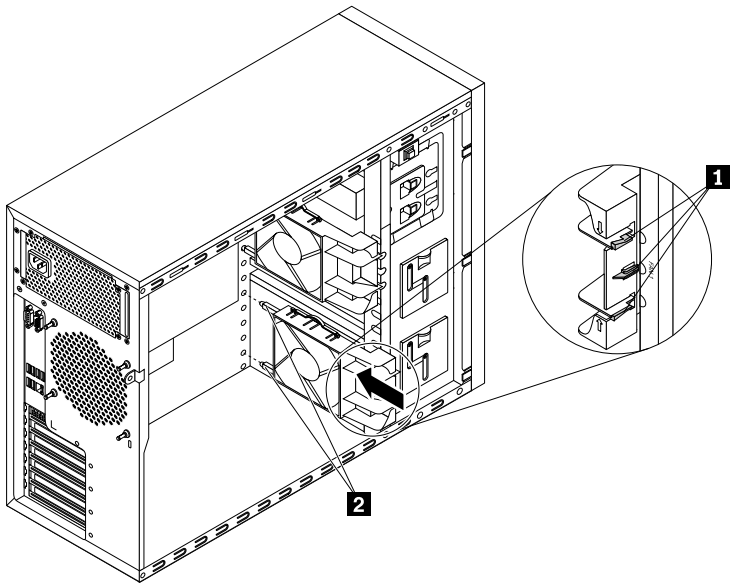


Figure 102. Installing the front system fan 1

8. Connect the new front system fan 1 cable to the system fan 1 connector on the system board. See "System board components" on page 39.
9. If you are instructed to return the old front system fan 1, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

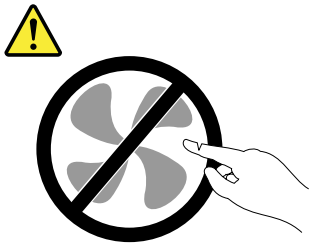
- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to "Completing the parts replacement" on page 163.

Replacing the rear system fan

Attention: Do not open your server or attempt any repair before reading and understanding "Safety information" on page iii and "Guidelines" on page 65.

This topic provides instructions on how to replace the rear system fan.

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the rear system fan, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Locate the rear system fan. See “Server components” on page 23.
4. Disconnect the rear system fan cable from the rear system fan connector on the system board. See “System board components” on page 39.
5. The rear system fan is attached to the chassis by four rubber mounts. Remove the rear system fan by cutting the rubber mounts and pulling the rear system fan out of the chassis.

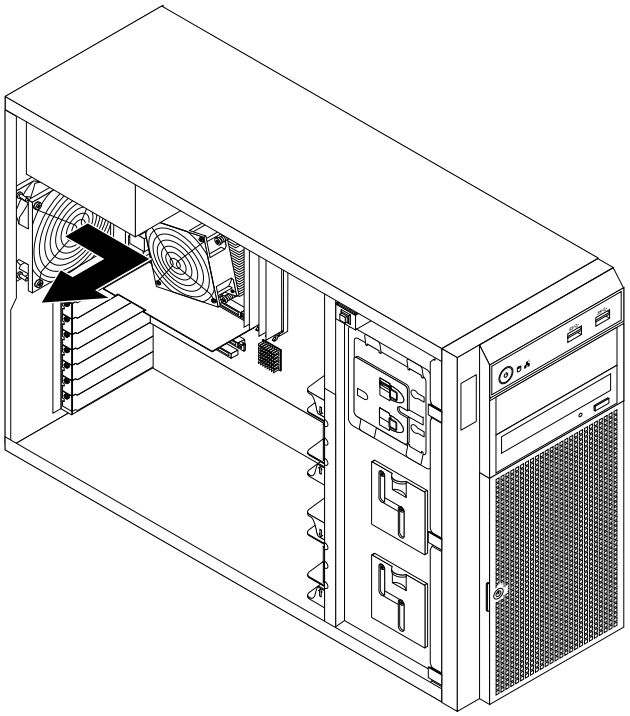


Figure 103. Removing the rear system fan

6. Touch the static-protective package that contains the new rear system fan to any unpainted surface on the outside of the server. Then, remove the new rear system fan from the package.
7. Position the new rear system fan, which has four new rubber mounts attached, on the chassis so that the four new rubber mounts are aligned with the corresponding holes in the chassis. Push the rubber mounts through the holes, and then pull on the tips of the rubber mounts from the other side of the chassis until the rear system fan is secured in place.

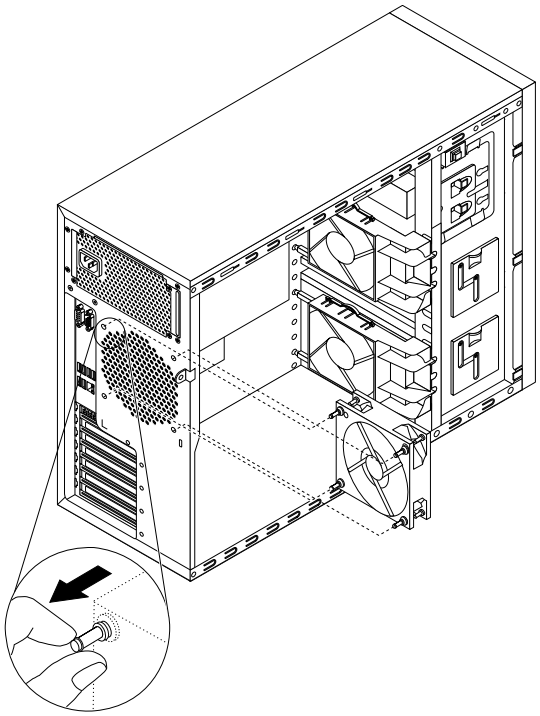


Figure 104. Installing the rear system fan

8. Connect the new rear system fan cable to the rear system fan connector on the system board. See “System board components” on page 39.
9. If you are instructed to return the old rear system fan, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

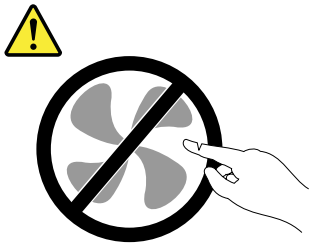
- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the heat sink and fan assembly

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the heat sink and fan assembly.

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



CAUTION:

The heat sink and fan assembly might be very hot. Turn off the server and wait three to five minutes to let the server cool before removing the server cover.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the heat sink and fan assembly, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Locate the heat sink and fan assembly. See “Server components” on page 23.
4. Lay the server on its side for easier operation. If necessary, remove any installed PCI Express card that might impede your access to the heat sink and fan assembly. See “Removing the Ethernet card” on page 81.
5. Disconnect the cable of the heat sink and fan assembly from the microprocessor fan connector on the system board. See “System board components” on page 39.

6. Remove the four screws that secure the heat sink and fan assembly to the system board. It is recommended that you carefully remove the four screws from the system board using the following method to avoid any possible damage to the system board.
   a. Partially remove screw 1, then completely remove screw 2, and then return to screw 1 and completely remove it.
   b. Partially remove screw 3, then completely remove screw 4, and then return to screw 3 and completely remove it.

   Note: The four screws are integrated parts of the heat sink and fan assembly. Do not try to remove the four screws from the heat sink and fan assembly.

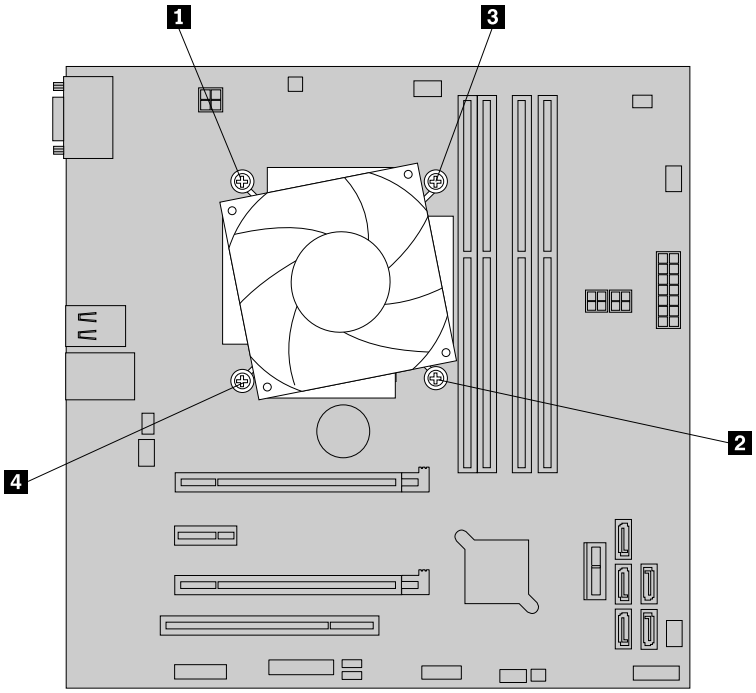


Figure 105. Removing the screws that secure the heat sink and fan assembly

7. Gently twist the heat sink and fan assembly to free it from the microprocessor, and then lift the heat sink and fan assembly off the system board.
8. Lay aside the old heat sink and fan assembly. Touch the static-protective package that contains the new heat sink and fan assembly to any unpainted surface on the outside of the server. Then, remove the new heat sink and fan assembly from the package.

   Notes:

   - When handling the heat sink and fan assembly, do not touch the thermal grease on the bottom of it.
   - Before installing the new heat sink and fan assembly, use the cleaning pad that comes with the new heat sink and fan assembly to wipe the thermal grease from the top of the microprocessor. Dispose of the cleaning pad after all thermal grease is removed from the microprocessor.
9. Place the new heat sink and fan assembly on the system board so that each of the four screws on the new heat sink and fan assembly is inserted into the corresponding mounting stud on the backplane. Note the orientation of the new heat sink and fan assembly and ensure that you properly place it so that you can easily connect the heat sink and fan assembly cable to the microprocessor fan connector on the system board. See “System board components” on page 39.

10. Install the four screws to secure the new heat sink and fan assembly and the backplane on the system board. It is recommended that you carefully install the four screws using the following method to avoid any possible damage to the system board.
    a. Partially tighten screw 1, then firmly tighten screw 2, and then return to screw 1 and firmly tighten it. Do not over-tighten the screws.
    b. Partially tighten screw 3, then firmly tighten screw 4, and then return to screw 3 and firmly tighten it. Do not over-tighten the screws.

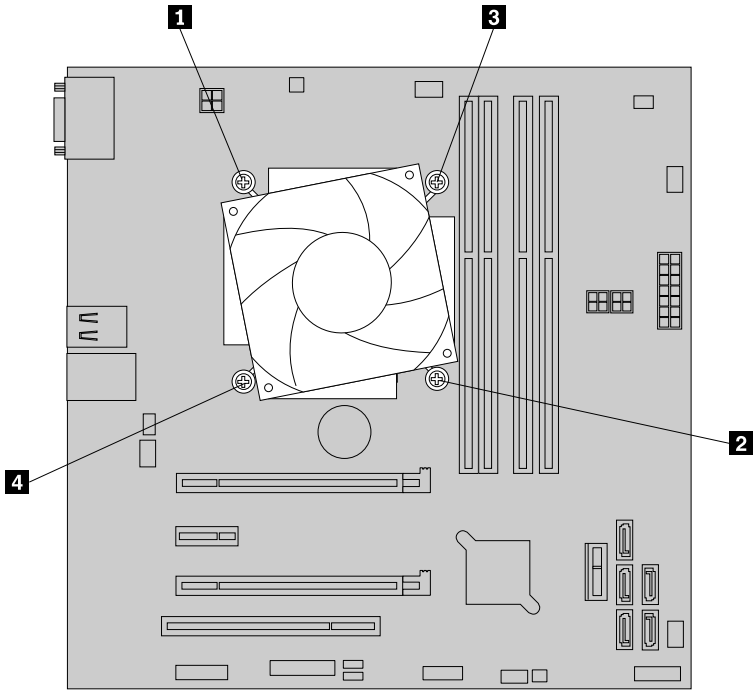


Figure 106. Installing the screws to secure the heat sink and fan assembly and the backplane

11. Connect the heat sink and fan assembly cable to the microprocessor fan connector on the system board. See “System board components” on page 39.

    Note: If the heat sink and fan assembly cable is long, loosely wrap it.

12. If you are instructed to return the old heat sink and fan assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the microprocessor

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the microprocessor.

CAUTION:

The heat sink and fan assembly and the microprocessor might be very hot. Turn off the server and wait three to five minutes to let the server cool before removing the server cover.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Notes:

- Ensure that the new microprocessor is the correct type your server supports. See “Memory module installation rules” on page 74.
- Use any documentation that comes with the microprocessor option kit and follow those instructions in addition to the instructions in this topic.
- Your microprocessor, socket, and socket cover might look slightly different from the illustrations in this topic.

To replace the microprocessor, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Remove the heat sink and fan assembly. See “Replacing the heat sink and fan assembly” on page 148.

5. Gently press down the small handle on the microprocessor socket, and then pull the handle a little bit outward to release it from the secured position. Then, pivot the handle upward until the handle and the microprocessor retainer are in the fully open position.

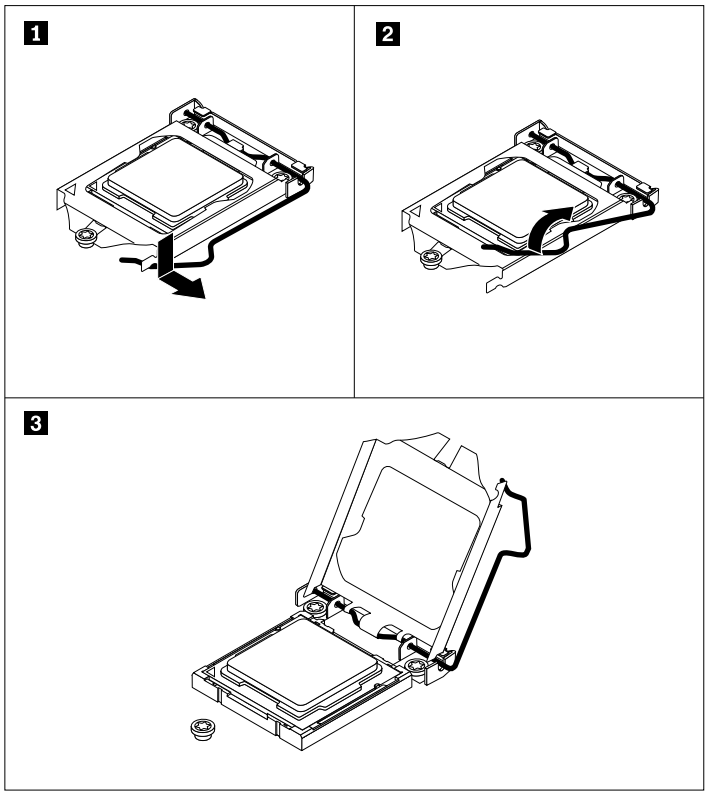


Figure 107. Lifting the handle to open the microprocessor retainer

6. Touch only the edges of the microprocessor and carefully lift it straight up and out of the microprocessor socket. Place the old microprocessor on a static-protective surface.

   Notes:

   - Do not touch the gold contacts on the bottom of the microprocessor.
   - Do not drop anything onto the microprocessor socket while it is exposed. The socket pins must be kept as clean as possible.

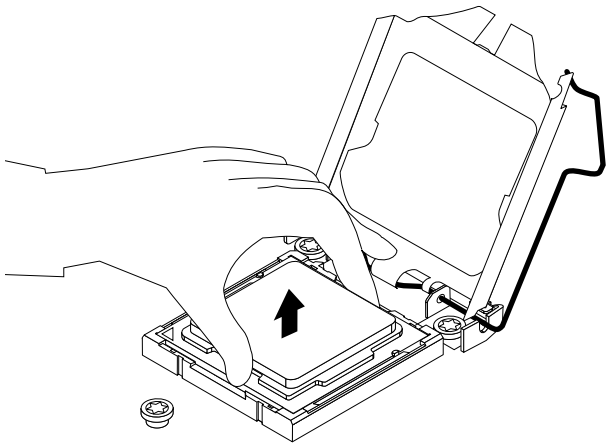


Figure 108. Removing the microprocessor

7. Touch the static-protective package that contains the new microprocessor to any unpainted surface on the outside of the server. Then, remove the new microprocessor from the package.
8. Remove the protective cover that protects the gold contacts on the bottom of the new microprocessor.

   Note: Do not touch the pins on the microprocessor socket and the gold contacts on the bottom of the new microprocessor.

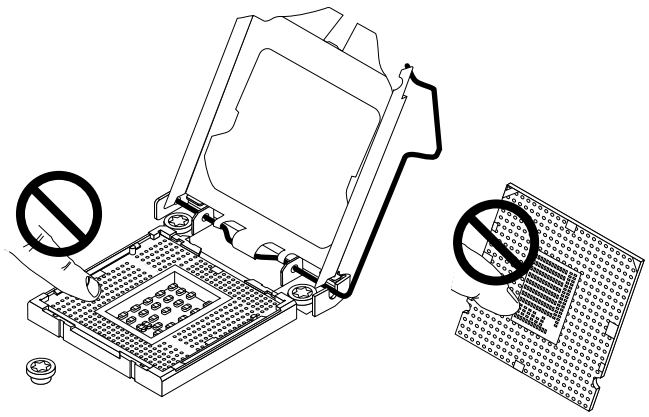


Figure 109. Do not touch the pins

9. Note the orientation of the new microprocessor. Hold the new microprocessor by its edges and align the notches 1 on it with the tabs 2 in the microprocessor socket. Then, carefully lower the new microprocessor straight down into the microprocessor socket.

   Note: The small triangle 3 on one corner of the new microprocessor is the microprocessor orientation indicator. The new microprocessor is in the correct orientation when this indicator faces the beveled corner 4 of the microprocessor socket.

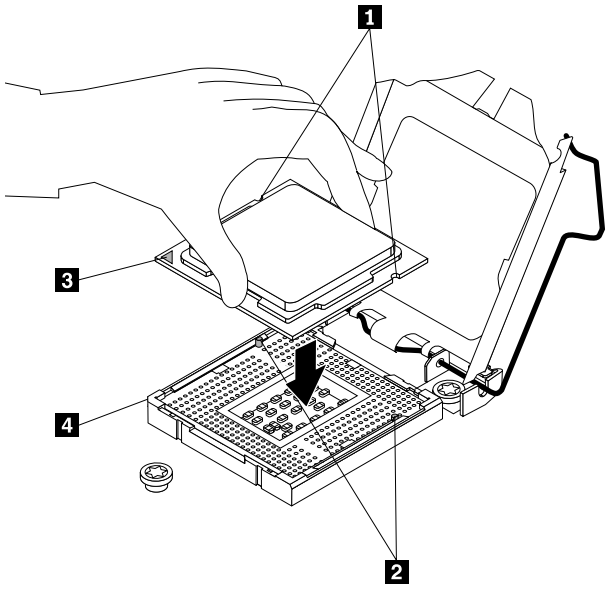


Figure 110. Installing the microprocessor

10. Gently close the microprocessor retainer, press down the small handle, and then push the handle inward to lock the retainer into position and secure the new microprocessor in the socket.

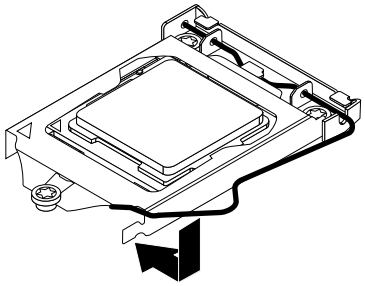


Figure 111. Securing the microprocessor in the socket

11. Reinstall the heat sink and fan assembly. See “Replacing the heat sink and fan assembly” on page 148.
12. If you are instructed to return the old microprocessor, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the system board battery

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the system board battery.

Your server has a special type of memory that maintains the date, time, and configuration information for built-in features. The system board battery keeps the information active when you turn off the server. The system board battery normally requires no charging or maintenance throughout its life; however, no battery lasts forever. If the system board battery fails, the date, time, and configuration information, including passwords, are lost and an error message is displayed when you turn on the server.

DANGER

Danger of explosion if battery is incorrectly replaced.

When replacing the lithium coin cell battery, use only the same or an equivalent type that is recommended by the manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

The following statement applies to users in the state of California, U.S.A.

California Perchlorate Information:

Products containing manganese dioxide lithium coin cell batteries may contain perchlorate.

Perchlorate Material - special handling may apply, See http://www.dtsc.ca.gov/hazardouswaste/perchlorate

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

To replace the system board battery, do the following:

Note: After you replace the system board battery, you must reset passwords, reset system date and time, and reconfigure the server. See Chapter 5 “Configuring the server” on page 47.

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Locate the system board battery. See “Server components” on page 23.
5. Remove any installed PCI Express card (such as the RAID card) that impedes your access to the system board battery. See “Removing the RAID card” on page 83.

6. Remove the old system board battery.

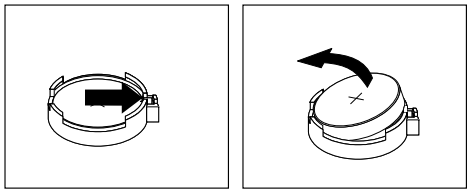


Figure 112. Removing the system board battery

7. Install a new system board battery.

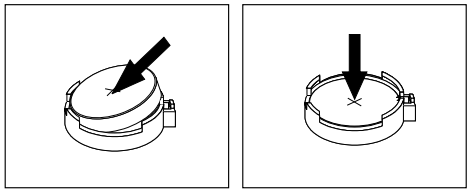


Figure 113. Installing the system board battery

8. Reinstall the PCI Express card (such as the RAID card) that has been removed. See “Installing the RAID card” on page 83.
9. Dispose of the old system board battery as required by local ordinances or regulations.

What to do next:

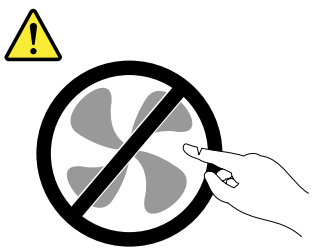
- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 163.

Replacing the system board

Attention: Do not open your server or attempt any repair before reading and understanding the “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to replace the system board.

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.



CAUTION:

The heat sink and microprocessor might be very hot. Turn off the server and wait three to five minutes to let the server cool before removing the server cover.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To replace the system board, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Removing the server cover” on page 67.
3. Lay the server on its side for easier operation.
4. Record the component locations, cable connections, and cable routing in the server.
5. Remove all memory modules and PCI cards (including the Ethernet card and RAID card) that are currently installed. See “Removing a memory module” on page 77, “Removing the Ethernet card” on page 81, and “Removing the RAID card” on page 83.
6. Remove the heat sink and fan assembly and place it on a clean, flat, and static-protective surface. See “Replacing the heat sink and fan assembly” on page 148.
7. Remove any other parts and disconnect all cables from the system board.

8. Remove the eight screws that secure the system board following the recommended numerical sequence as shown. Then, carefully remove the system board out of the chassis.

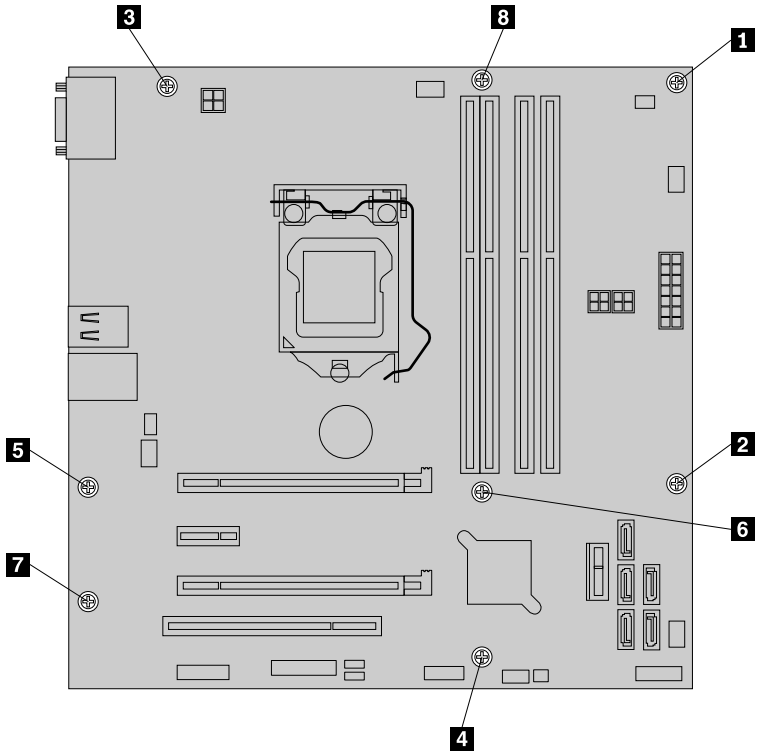


Figure 114. Removing the screws that secure the system board

9. Place the old system board on a clean, flat, and static-protective surface. Touch the static-protective package that contains the new system board to any unpainted surface on the outside of the server. Then, remove the new system board from the package.

10. Note the orientation of the new system board and carefully place it into the chassis. Ensure that the rear connectors on the new system board are inserted into the corresponding holes in the rear panel and the eight screw holes in the new system board are aligned with the corresponding mounting studs on the chassis. Then, install the eight screws following the recommended numerical sequence as shown to secure the new system board in place.

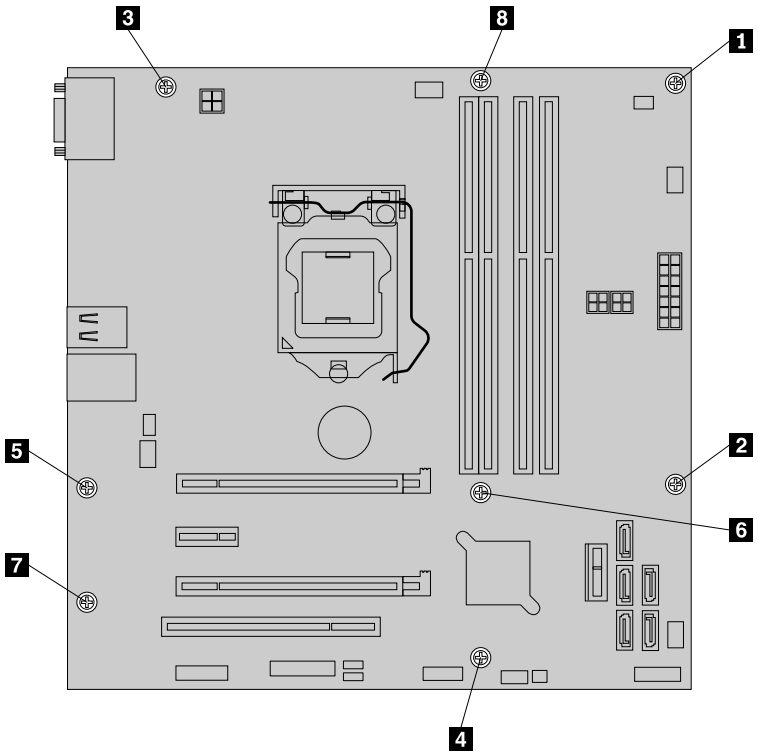


Figure 115. Installing the screws to secure the system board

11. For the new system board, gently press down the small handle on the microprocessor socket and then pull the handle slightly outward to release it from the secured position. Then, pivot the handle upward until the handle and the microprocessor retainer are in the fully open position. Remove the microprocessor socket cover from the microprocessor socket.

    Note: Do not drop anything onto the microprocessor socket while it is exposed. The socket pins must be kept as clean as possible.

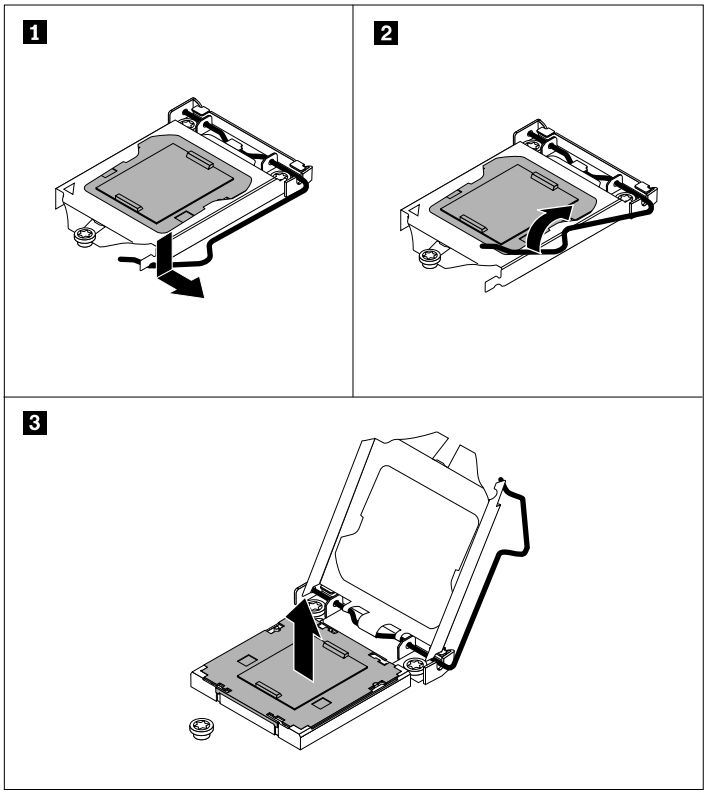


Figure 116. Removing the microprocessor socket cover

12. Remove the microprocessor from the old system board and install it on the new system board. See “Replacing the microprocessor” on page 151.
13. The old system board must be returned with a microprocessor socket cover to protect the pins on the microprocessor socket during shipping and handling. Use the microprocessor socket cover removed from the new system board.

To install a microprocessor socket cover on the old system board, do the following:

a. Ensure that the small handle and the microprocessor retainer are in the fully open position. Hold the microprocessor socket cover and align the small triangle 3 on the socket cover with the beveled corner 4 on the microprocessor socket. You also can align the notches 1 on the socket cover with the tabs 2 in the microprocessor socket. Then, lower the socket cover into the socket and carefully press the socket cover until it snaps into position.

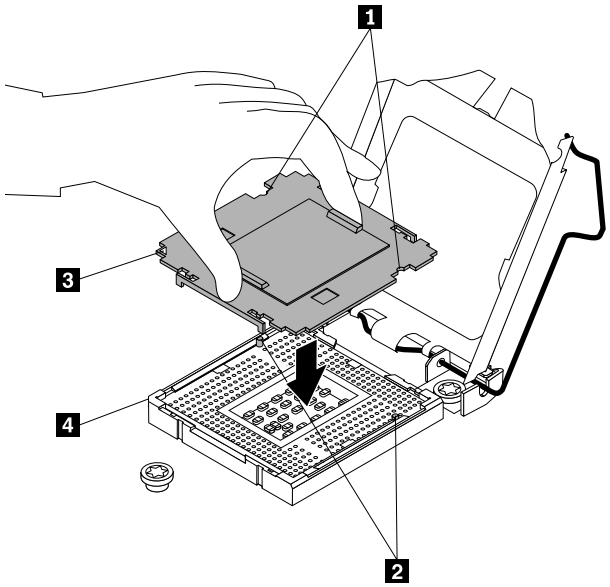


Figure 117. Installing the microprocessor socket cover

b. Gently close the microprocessor retainer, press down the small handle, and then push the handle inward to lock the retainer into position and secure the microprocessor socket cover in the socket.

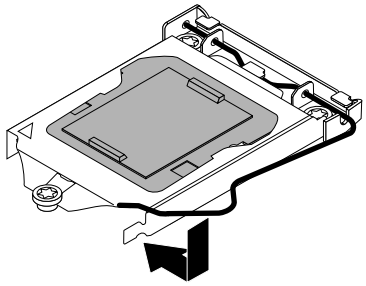


Figure 118. Securing the microprocessor socket cover

14. Install all parts that you have removed and connect all cables to the new system board. Refer to the information that you have recorded and the related topics in “Installing, removing, or replacing hardware” on page 74.
15. If you are instructed to return the old system board, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

What to do next:

- To work with another piece of hardware, go to the appropriate section.

- To complete the replacement, go to “Completing the parts replacement” on page 163.
- After a system board is replaced, do the following:
  1. Start the Setup Utility program by pressing the F1 key, and then check the BIOS and BMC version.
  2. Go to http://www.lenovo.com/drivers and follow the instructions on the Web page to download the latest version of firmware. Then, install the firmware to your server.
  3. Update the machine type, model number, and serial number of the system board. Either you will be prompted to do this while upgrading the BIOS, or you can locate the utility for updating the VPD within the DOS BIOS package. For some servers, the VPD utility is available for download at http://www.lenovo.com/drivers.

  Note: If you want to use the Firmware Updater program, ensure that it is the latest version. To get the latest version of the Firmware Updater program, go to http://www.lenovo.com/drivers, locate different versions of the program, and then identify the latest version by comparing readme files. If the latest version of the Firmware Updater program does not contain the latest version of the driver you need, download that driver separately from the Web page and install it individually to your server.

Completing the parts replacement

This topic provides instructions to help you complete the parts replacement and turn on your server.

To complete the parts replacement, properly route the cables inside the server, reinstall the server cover, reconnect all the external cables. For some devices, update the firmware and run the Setup Utility program to do further setup.

Reinstalling the server cover and reconnecting cables

Attention: Do not open your server or attempt any repair before reading and understanding “Safety information” on page iii and “Guidelines” on page 65.

This topic provides instructions on how to reinstall the server cover and reconnect cables to your server.

Attention: For proper cooling and airflow, reinstall the server cover before turning on the server. Operating the server for extended periods of time (more than 30 minutes) with the server cover removed might damage server components.

Before you begin, print all the related instructions or ensure that you can view the PDF version on another computer for reference.

Note: Depending on the model, your server might look slightly different from the illustrations in this topic.

To reinstall the server cover and reconnect cables to your server, do the following:

1. Ensure that all components have been reassembled correctly and that no tools or loose screws are left inside your server.
2. Refer to your note to connect internal cables. Ensure that all internal cables are routed correctly and secured by any cable clips or ties in the server. Keep cables clear of the hinges and sides of the server chassis to avoid interference with reinstalling the server cover.

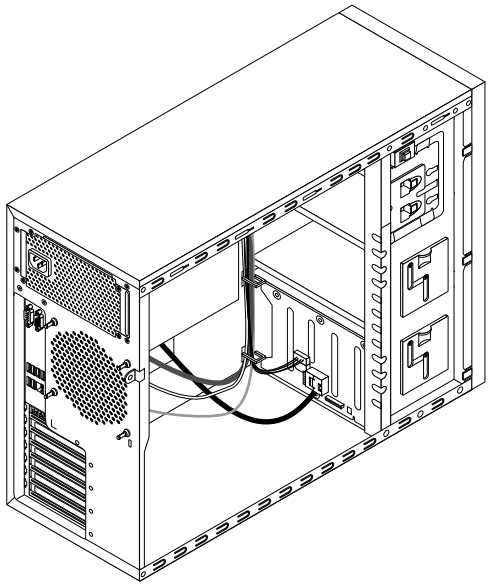


Figure 119. Cable routing

3. If you have removed the front bezel, reinstall it. See “Removing and reinstalling the front bezel” on page 69.
4. Position the server cover on the chassis so that the rail on the bottom of the server cover engages the bottom rail on the chassis. Then, align the four tabs **1** on the server cover with the corresponding holes in the top edge of the chassis. Pivot the server cover to close it.

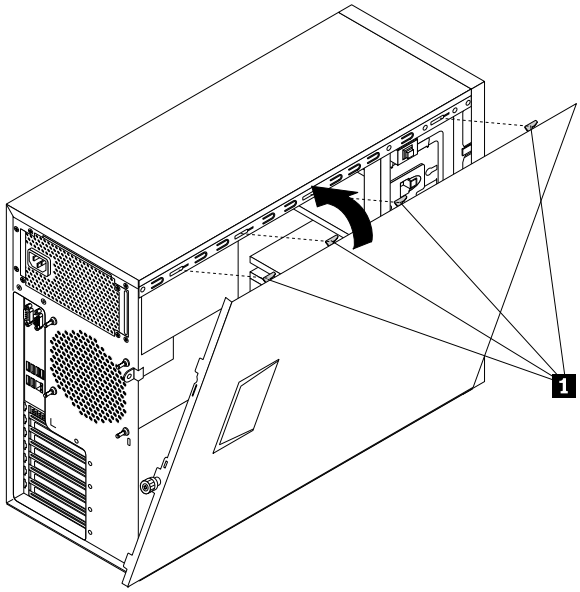


Figure 120. Closing the server cover

5. Slide the server cover to the front of the chassis until it snaps into position.

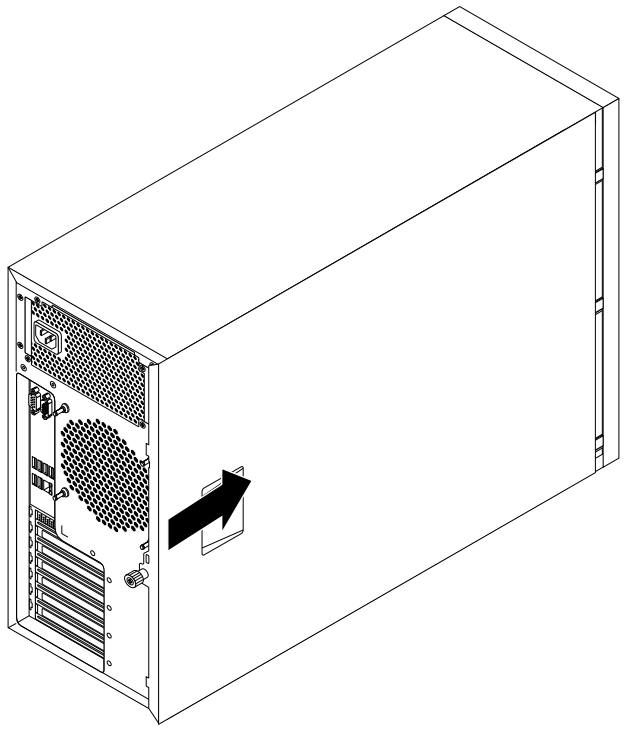


Figure 121. Installing the server cover

6. Tighten the thumbscrew on the server cover to secure the server cover in place.

   Note: For safety consideration, ensure that you use a tool, for example a screwdriver, to tighten the thumbscrew and always ensure that the thumbscrew is securely installed. Also, do not over-tighten the thumbscrew.
7. Lock the server cover and server front door to ensure the security. See “Server locks” on page 20.
8. Reconnect external cables and power cords to the server. See “Rear view of the server” on page 17 to identify the connectors on the rear panel of the server.

   Attention: To avoid component damage, connect the power cords last.

Note: In most areas of the world, Lenovo requires the return of the defective CRU. Information about this will come with the CRU or will come a few days after the CRU arrives.

Updating the server configuration

When you turn on the server for the first time after you install, remove, or replace a device, you might need to update the server configuration.

Some optional devices have device drivers that you must install. For information about installing device drivers, use the documentation that comes with each optional device. To obtain the supported device drivers for your server from the Lenovo Support Web site, go to http://www.lenovo.com/drivers follow the instructions on the Web page to find and download the device drivers you need.

Refer to the following information resources to update the server configuration:

- To update the BIOS configuration, see “Using the Setup Utility program” on page 47.
- To update the RAID configuration, see “Configuring RAID” on page 57.
- To use the ThinkServer EasyStartup program, see “Using the ThinkServer EasyStartup program” on page 54.
- To update your system firmware, see “Updating the firmware” on page 62.

Chapter 7. Troubleshooting and diagnostics

This chapter provides information about basic troubleshooting and diagnostic methods to help you solve problems that might occur in the server.

If you cannot diagnose and correct a problem by using the information in this chapter, see Chapter 8 “Getting information, help, and service” on page 173 for additional troubleshooting resources.

Troubleshooting procedure

Use the following information as a general procedure for diagnosing and troubleshooting problems you experience with your server:

1. Verify that the power cords and the cables for all attached devices are connected correctly and securely.
2. Verify that the server and all attached devices that require ac power are connected to properly grounded, functioning electrical outlets.
3. Verify that all installed hardware and attached devices are enabled in the BIOS settings of your server. For more information about accessing and changing the BIOS settings, see “Using the Setup Utility program” on page 47.
4. View the status and diagnostic LEDs to identify the system and device status and diagnose problems. See “Viewing the status and diagnostic LEDs” on page 167.
5. If the server is not working after you have added new software, installed a new optional device, or replaced a piece of hardware, remove or reinstall the software or device to see if the problem could be solved.
6. Turn on the server and press Esc as soon as you see the logo screen to view any diagnostic messages.
7. Download and use a diagnostic program to diagnose problems. See “Using a diagnostic program” on page 167.
8. Refer to “Basic troubleshooting tables” on page 168 and follow the instructions for the type of problem you are experiencing. If the basic troubleshooting information does not help you resolve a problem, continue with the next step.
9. Try using a previous server configuration to see if a recent change to hardware or software settings has caused a problem. Before restoring your previous configuration, capture your current configuration in case the older configuration settings do not solve the problem or have adverse effect.
10. Use an antivirus program to see if your server has been infected by a virus. If the program detects a virus, remove the virus.
11. If none of these actions solve the problem, seek technical assistance. See Chapter 8 “Getting information, help, and service” on page 173.

Viewing the status and diagnostic LEDs

Your server has status and diagnostic LEDs on the front panel, the rear panel (Ethernet status LEDs), the system board, the hot-swap hard disk drives (if supported), and the optical drives. The various LEDs help you easily identify the system and device status and diagnose problems. For information about the LEDs, refer to the related topics in “Locations” on page 12.

Using a diagnostic program

The following diagnostic programs are available for you to diagnose server problems:

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- ThinkServer Diagnostic Tool
- ThinkServer System Profile Collection Tool

To use a diagnostic program, do the following:

1. Go to http://www.lenovo.com/drivers and follow the instructions on the Web page to locate a diagnostic program.
2. Download and unzip the diagnostic program package to get the diagnostic program package folder.
3. Open the diagnostic program package folder and run the QTW.exe file.
4. Select the language when prompted. Then, click **Continue**.
5. Read the End-User License Agreement (EULA) terms carefully and click **Accept** to start the program.
6. Follow the instructions on the screen to use the diagnostic program.

For detailed information about using a diagnostic program, refer to the user guide of the diagnostic program, which is available for download at:
http://www.lenovo.com/drivers

Basic troubleshooting tables

Use the basic troubleshooting information to find solutions to problems that have definite symptoms.

ThinkServer EasyStartup program problems

Follow the suggested actions for the corresponding symptom in the order in which they are listed until the problem is solved. If none of these actions solve the problem, see “Troubleshooting procedure” on page 167 for the subsequent steps you should check after using the information in this topic. If the problem cannot be solved by yourself, seek technical assistance. See Chapter 8 “Getting information, help, and service” on page 173.

Note: If you are instructed to remove, install, or replace any CRUs, refer to the related procedure in Chapter 6 “Installing, removing, or replacing hardware” on page 65.

Symptom	Action
The *ThinkServer EasyStartup* DVD does not start.	1. Ensure that the server supports the ThinkServer EasyStartup program and has a bootable DVD drive. 2. Ensure that you have set the optical drive with the *ThinkServer EasyStartup* DVD as the first startup device. 3. Verify if the optical drive or the disc has problems. See “Optical drive problems” on page 169.
The operating system installation program continuously loops.	Make more space available on the hard disk drive.
The ThinkServer EasyStartup program cannot start the operating system media.	1. Ensure that the operating system media is supported by the ThinkServer EasyStartup program version your are using. For a list of the supported operating systems, refer to the user guide and compatibility notes for the ThinkServer EasyStartup program through the program main interface. See “Starting the ThinkServer EasyStartup program” on page 55. 2. Verify if the optical drive or the disc has problems. See “Optical drive problems” on page 169.

Optical drive problems

Follow the suggested actions for the corresponding symptom in the order in which they are listed until the problem is solved. If none of these actions solve the problem, see “Troubleshooting procedure” on page 167 for the subsequent steps you should check after using the information in this topic. If the problem cannot be solved by yourself, seek technical assistance. See Chapter 8 “Getting information, help, and service” on page 173.

Notes:

1. If you are instructed to remove, install, or replace any CRUs, refer to the related procedure in Chapter 6 “Installing, removing, or replacing hardware” on page 65.
2. If an action step is preceded by “(Trained service technician only),” this action step is reserved for a trained service technician and must be performed only by a trained service technician.

Symptom	Action
The optical drive is not recognized.	1. Ensure that: • The signal cable and connector are not damaged and the connector pins are not bent. • The optical drive is securely connected to the correct SATA connector on the system board and the SATA connector is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 47. • All cables and jumpers (if any) are installed correctly. • The correct device driver is installed for the optical drive. 2. Run any optical drive diagnostic programs if you have. 3. Reinstall the optical drive and reconnect cables. 4. Replace the signal cable for the optical drive. 5. Replace the optical drive. 6. (Trained service technician only) Replace the system board.
A disc is not working correctly.	1. Ensure that the disc is in the optical drive with the shiny side facing down. 2. Ensure that the disc surface is clean and not scratched. 3. Check the disc or package for regional coding. You might need to purchase a disc with coding for the region where you are using the product. 4. Restart the disc player program. 5. Restart the server. 6. Run any optical drive diagnostic programs if you have. 7. Reinstall the optical drive and reconnect cables. 8. Replace the signal cable for the optical drive. 9. Replace the optical drive.

Hard-disk-drive problems

Follow the suggested actions for the corresponding symptom in the order in which they are listed until the problem is solved. If none of these actions solve the problem, see “Troubleshooting procedure” on page 167 for the subsequent steps you should check after using the information in this topic. If the problem cannot be solved by yourself, seek technical assistance. See Chapter 8 “Getting information, help, and service” on page 173.

Notes:

1. If you are instructed to remove, install, or replace any CRUs, refer to the related procedure in Chapter 6 “Installing, removing, or replacing hardware” on page 65.
2. If the server model comes with hot-swap hard disk drives, the status LEDs on each hot-swap hard disk drive help you easily identify a problem. See “Hot-swap hard-disk-drive status LEDs” on page 28.

Symptom	Action
A newly installed non-hot-swap hard disk drive is not recognized.	1. Ensure that: • The signal cable and connector are not damaged. • The non-hot-swap hard disk drive is securely connected to the correct SATA connector on the system board and the SATA connector is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 47. • All cables and jumpers (if any) are installed correctly. 2. If you have any diagnostic programs, run the diagnostic programs to test the hard disk drive. 3. Reinstall the non-hot-swap hard disk drive and reconnect cables. 4. Replace the signal cable for the non-hot-swap hard disk drive. 5. Replace the non-hot-swap hard disk drive.
A newly installed hot-swap hard disk drive is not recognized.	1. Ensure that the drive is installed into the correct drive bay. 2. Restart the server. 3. Remove the drive from the bay, wait 45 seconds, and reinsert the drive into the bay, making sure that the drive connects to the hot-swap hard-disk-drive backplane. 4. If you have any diagnostic programs, run the diagnostic programs to test the hard disk drive. 5. Ensure that the hot-swap hard-disk-drive backplane is correctly seated. When it is correctly seated, the drive assemblies correctly connect to the backplane without bowing or causing movement of the backplane. 6. Ensure that the cable connection is correct. See “Connecting the cables” on page 36. 7. Reconnect the backplane power cable and repeat step 1 through step 4. 8. Reconnect the backplane signal cable and repeat step 1 through step 4.

Symptom	Action
	9. If you suspect a problem with the backplane signal cable or the backplane: a. Replace the affected backplane signal cable. b. Replace the affected backplane.
Multiple hard disk drives fail.	1. If you have any diagnostic programs, run the diagnostic programs to test the hard disk drives. 2. Ensure that the cable connection is correct. See "Connecting the cables" on page 36. 3. Reconnect the power cable. 4. Reconnect the signal cable. 5. Replace the affected signal cable. 6. For hot-swap hard disk drives, if you suspect a problem with the backplane, replace the affected backplane.

Memory module problems

Follow the suggested actions for the corresponding symptom in the order in which they are listed until the problem is solved. If none of these actions solve the problem, see "Troubleshooting procedure" on page 167 for the subsequent steps you should check after using the information in this topic. If the problem cannot be solved by yourself, seek technical assistance. See Chapter 8 "Getting information, help, and service" on page 173.

Notes:

1. If you are instructed to remove, install, or replace any CRUs, refer to the related procedure in Chapter 6 "Installing, removing, or replacing hardware" on page 65.
2. If an action step is preceded by "(Trained service technician only)," this action step is reserved for a trained service technician and must be performed only by a trained service technician.

Symptom	Action
The amount of system memory that is displayed is less than the total capacity of the installed physical memory modules and you suspect a memory module problem.	1. Ensure that: • All memory modules are the correct type supported by the server. See "Features" on page 7. • You follow the memory module installation rules. See "Memory module installation rules" on page 74. • All memory modules are seated correctly and securely. • The system firmware is up-to-date. 2. If you have any diagnostic programs, run the diagnostic programs to test the memory modules. 3. Reinstall the memory modules. 4. Replace the suspect memory modules. 5. (Trained service technician only) Replace the system board.

Keyboard, mouse, or USB device problems

Follow the suggested actions for the corresponding symptom in the order in which they are listed until the problem is solved. If none of these actions solve the problem, see “Troubleshooting procedure” on page 167 for the subsequent steps you should check after using the information in this topic.

Symptom	Action
All or some keys on the keyboard do not work.	1. Ensure that: • The USB keyboard cable is securely connected to a USB connector on the server. If the USB keyboard is connected to a USB hub, disconnect the keyboard from the hub and connect it directly to the server. • No keys are stuck. • The USB controller is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 47. 2. Restart the server. 3. Replace the keyboard.
The mouse or pointing device does not work.	1. Ensure that: • The mouse or pointing device cable is securely connected to the server. If the USB mouse or pointing device is connected to a USB hub, disconnect the mouse or pointing device from the hub and connect it directly to the server. • The mouse or pointing device is clean and no dust accumulates. • The device drivers are installed correctly. • The USB controller is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 47. 2. Restart the server. 3. Replace the mouse or pointing device.
A USB device does not work.	1. Ensure that: • The USB cable is securely connected to the server. If the USB device is connected to a USB hub, disconnect the device from the hub and connect it directly to the server. • The device drivers are installed correctly. • The USB controller is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 47. 2. Restart the server. 3. Replace the USB device.

Chapter 8. Getting information, help, and service

This chapter contains information about help, service, and technical assistance for products manufactured by Lenovo and where to go for additional information about Lenovo and Lenovo products.

Information resources

You can use the information in this topic to access useful resources relating to your needs when using the product.

Using the documentation

Information about your Lenovo system and installed software, if any, or optional devices is available in the documentation that comes with the product. The documentation can include printed documents, online documents, readme files, and help files. Most of the documentation for your server is on the documentation DVD provided with your server. Refer to the troubleshooting information in your server *User Guide* for instructions on how to diagnose problems and do basic troubleshooting. The troubleshooting and diagnostics information might tell you that you need additional or updated device drivers or other software. Lenovo maintains pages on the World Wide Web where you can get the latest technical information and download documentation or device drivers and updates. To access the Lenovo Support Web site, go to: http://www.lenovo.com/support

For more information about your server documentation, see “Server documentation” on page 2.

If you suspect a software problem, refer to the documentation, including readme files and online help, that comes with the operating system or software program.

ThinkServer Web site

The ThinkServer Web site provides up-to-date information and services to help you buy, use, upgrade, and maintain your server. You also can do the following by visiting the ThinkServer Web site at: http://www.lenovo.com/thinkserver

- Shop for servers as well as upgrades and accessories for your server.
- Purchase additional services and software.
- Purchase upgrades and extended hardware repair services.
- Access the Lenovo Limited Warranty (LLW).
- Access the online manuals for your products.
- Access troubleshooting and support information for your server model and other supported products.
- Download the latest device drivers and software updates for your server model.
- Find the service and support phone numbers for your country or region.
- Find a Service Provider located near you.

Lenovo Support Web site

Technical support information is available on the Lenovo Support Web site at: http://www.lenovo.com/support

This Web site is updated with the latest support information such as the following:

- Drivers and software

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- Diagnostic solutions
- Product and service warranty
- Product and parts details
- User guides and manuals
- Knowledge base and frequently asked questions

Help and service

This topic contains information about obtaining help and service.

Before you call

Before you call, do the following to try to solve the problem by yourself:

- Check all cables to ensure that they are connected.
- Check the power buttons to ensure that the system and optional devices are turned on.
- Use the troubleshooting information in your system documentation on the documentation DVD that comes with your product.
- Check for the updated information, new device drivers, and hints and tips on the Lenovo Support Web site at:
  http://www.lenovo.com/support
- Download the diagnostic program from the Web site, and then run it. See “Using a diagnostic program” on page 167.

If possible, be at your product when you call. Have the following information available:

- Machine type and model
- Serial numbers of your Lenovo hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

Calling for service

During the warranty period, you can get help and information by telephone through the Customer Support Center.

The following services are available during the warranty period:

- **Problem determination** - Trained service personnel are available to assist you with determining a hardware problem and deciding what action is necessary to fix the problem.
- **Hardware repair** - If the problem is caused by hardware under warranty, trained service personnel are available to provide the applicable level of service.
- **Engineering Change management** - There might be changes that are required after a product has been sold. Lenovo or your reseller will make selected Engineering Changes (ECs) that apply to your hardware available.

The warranty does not cover the following:
- Replacement or use of parts not manufactured for or by Lenovo or non-warranted Lenovo parts
- Identification of software problem sources
- Configuration of the UEFI BIOS as part of an installation or upgrade
- Changes, modifications, or upgrades to device drivers
- Installation and maintenance of network operating systems (NOS)
- Installation and maintenance of application programs

For the warranty type and duration for your product, refer to the *Warranty and Support Information* on the documentation DVD that comes with your server. You must retain your proof of purchase to obtain warranty service.

For warranty service, consult the worldwide Lenovo Support telephone list. Telephone numbers are subject to change without notice. The most up-to-date telephone list for Lenovo Support is always available on the Web site at http://www.lenovo.com/support/phone. If the telephone number for your country or region is not listed, contact your Lenovo reseller or Lenovo marketing representative.

Using other services

If you travel with a Lenovo notebook computer or relocate your computer to a country where your desktop, notebook, or server machine type is sold, your computer might be eligible for International Warranty Service, which automatically entitles you to obtain warranty service throughout the warranty period. Service will be performed by service providers authorized to perform warranty service.

Service methods and procedures vary by country, and some services might not be available in all countries. International Warranty Service is delivered through the method of service (such as depot, carry-in, or on-site service) that is provided in the servicing country. Service centers in certain countries might not be able to service all models of a particular machine type. In some countries, fees and restrictions might apply at the time of service.

To determine whether your computer is eligible for International Warranty Service and to view a list of the countries where service is available, go to http://www.lenovo.com/support, click **Warranty**, and follow the instructions on the screen.

For technical assistance with the installation of or questions related to Service Packs for your installed Windows product, refer to the Microsoft Product Support Services Web site at http://support.microsoft.com/directory or you can contact the Customer Support Center. Some fees might apply.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for hardware, operating systems, and application programs; network setup and configuration services; upgraded or extended hardware repair services; and custom installation services. Service availability and service names might vary by country or region. For more information about these services, go to the Lenovo Web site at: http://www.lenovo.com

Appendix A. Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area. Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service.

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Any references in this publication to non-Lenovo Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this Lenovo product, and use of those Web sites is at your own risk.

Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

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Trademarks

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Intel, Intel Core, and Intel Xeon are trademarks of Intel Corporation in the United States, other countries, or both.

Linux is a registered trademark of Linus Torvalds.

Microsoft and Windows are trademarks of the Microsoft group of companies.

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Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1 024 bytes, MB stands for 1 048 576 bytes, and GB stands for 1 073 741 824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity can vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard-disk-drive bays with the largest currently supported drives that are available from Lenovo.

Maximum memory might require replacement of the standard memory with an optional memory module.

Lenovo makes no representations or warranties with respect to non-Lenovo products. Support (if any) for the non-Lenovo products is provided by the third party, not Lenovo.

Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

Polyvinyl Chloride (PVC) cable and cord notice

WARNING: Handling the cord on this product or cords associated with accessories sold with this product will expose you to lead, a chemical known to the State of California to cause cancer, and birth defects or other reproductive harm. ***Wash hands after handling***.

Recycling information

Lenovo encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. Lenovo offers a variety of programs and services to assist equipment owners in recycling their IT products. For information on recycling Lenovo products, go to:
http://www.lenovo.com/recycling

Recycling and disposal information for Japan is available at:
http://www.lenovo.com/recycling/japan

Battery return program

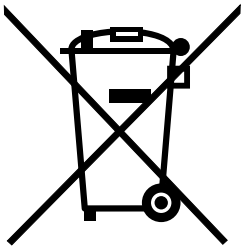
This product may contain a lithium or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal or batteries outside the United States, go to http://www.lenovo.com/recycling or contact your local waste disposal facility.

Battery recycling information for the United States and Canada

US & Canada Only

Battery recycling information for the European Union

EU



Notice: This mark applies only to countries within the European Union (EU).

Batteries or packaging for batteries are labeled in accordance with European Directive 2006/66/EC concerning batteries and accumulators and waste batteries and accumulators. The Directive determines the framework for the return and recycling of used batteries and accumulators as applicable throughout the European Union. This label is applied to various batteries to indicate that the battery is not to be thrown away, but rather reclaimed upon end of life per this Directive.

In accordance with the European Directive 2006/66/EC, batteries and accumulators are labeled to indicate that they are to be collected separately and recycled at end of life. The label on the battery may also include a chemical symbol for the metal concerned in the battery (Pb for lead, Hg for mercury, and Cd for cadmium). Users of batteries and accumulators must not dispose of batteries and accumulators as unsorted municipal waste, but use the collection framework available to customers for the return, recycling, and treatment of batteries and accumulators. Customer participation is important to minimize any potential effects of batteries and accumulators on the environment and human health due to the potential presence of hazardous substances. For proper collection and treatment, go to:
http://www.lenovo.com/recycling

Requirement for batteries containing perchlorate

The following statement applies to users in the state of California, U.S.A.

California Perchlorate Information:

Products containing manganese dioxide lithium coin cell batteries may contain perchlorate.

Perchlorate Material - special handling may apply, See
www.dtsc.ca.gov/hazardouswaste/perchlorate

Particulate contamination

Attention: Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the server that is described in this document. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the server to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If Lenovo determines that the levels of particulates or gases in your environment have caused damage to the server, Lenovo may condition provision of repair or replacement of servers or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 3. Limits for particulates and gases

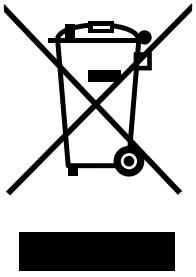
Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2[1]. • Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. • The deliquescent relative humidity of the particulate contamination must be more than 60%[2]. • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985[3] • Silver: Corrosion rate of less than 300 Å in 30 days

[1] ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[2] The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.

[3] ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

Important WEEE information



The WEEE marking on Lenovo products applies to countries with WEEE and e-waste regulations (for example, European Directive 2002/96/EC, India E-Waste Management & Handling Rules, 2011). Appliances are

labeled in accordance with local regulations concerning waste electrical and electronic equipment (WEEE). These regulations determine the framework for the return and recycling of used appliances as applicable within each geography. This label is applied to various products to indicate that the product is not to be thrown away, but rather put in the established collection systems for reclaiming these end of life products.

Users of electrical and electronic equipment (EEE) with the WEEE marking must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to them for the return, recycle, and recovery of WEEE and to minimize any potential effects of EEE on the environment and human health due to the presence of hazardous substances. For additional WEEE information go to: http://www.lenovo.com/recycling

Restriction of Hazardous Substances Directive (RoHS)

This topic provides statements about the Restriction of Hazardous Substances Directive (RoHS).

European Union RoHS

Lenovo products sold in the European Union, on or after 3 January 2013 meet the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (“RoHS recast” or “RoHS 2”).

For more information about Lenovo progress on RoHS, go to:
http://www.lenovo.com/social_responsibility/us/en/RoHS_Communication.pdf

Turkish RoHS

The Lenovo product meets the requirements of the Republic of Turkey Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (EEE).

Tьrkiye EEE Yцnetmelipine Uygunluk Beyanэ

Bu Lenovo ьrьnь, T.C. 3evre ve Orman Bakanlэpэ'nэn “Elektrik ve Elektronik Eюyalarda Bazэ Zararlэ Maddelerin Kullanэmэnэn Sэnэrlandэrэlmasэna Dair Yцnetmelik (EEE)” direktiflerine uygundur.

EEE Yцnetmelipine Uygundur.

German Ordinance for Work gloss statement

The product is not suitable for use with visual display work place devices according to clause 2 of the German Ordinance for Work with Visual Display Units.

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

Export classification notice

This product is subject to the United States Export Administration Regulations (EAR) and has an Export Classification Control Number (ECCN) of 4A994.b. It can be re-exported except to any of the embargoed countries in the EAR E1 country list.

Electronic emission notices

The following information refers to the Lenovo ThinkServer machine types 70AL, 70AM, 70AN, and 70AQ.

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Lenovo is not responsible for any radio or television interference caused by using other than specified or recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

United Kingdom telecommunications safety requirement

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

European Union - Compliance to the Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. Lenovo cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the installation of option cards from other manufacturers.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Lenovo, Einsteinova 21, 851 01 Bratislava, Slovakia

CE

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

German Class A compliance statement

Deutschsprachiger EU Hinweis:

Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit
Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG (früher 89/336/EWG) zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der Lenovo empfohlene Kabel angeschlossen werden. Lenovo übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt

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Deutschland:

Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Betriebsmittein
Dieses Produkt entspricht dem „Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln“ EMVG (früher „Gesetz über die elektromagnetische Verträglichkeit von Geräten“). Dies ist die Umsetzung der EU-Richtlinie 2004/108/EG (früher 89/336/EWG) in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln, EMVG vom 20. Juli 2007 (früher Gesetz über die elektromagnetische Verträglichkeit von Geräten), bzw. der EMV EG Richtlinie 2004/108/EC (früher 89/336/EWG), für Geräte der Klasse A.

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen. Verantwortlich für die Konformitätserklärung nach Paragraf 5 des EMVG ist die Lenovo (Deutschland) GmbH, Gropiusplatz 10, D-70563 Stuttgart.

Informationen in Hinsicht EMVG Paragraf 4 Abs. (1) 4:
Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

Nach der EN 55022: „Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen.“

Nach dem EMVG: „Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministers für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind.“ (Auszug aus dem EMVG, Paragraph 3, Abs. 4). Dieses Genehmigungsverfahren ist nach Paragraph 9 EMVG in Verbindung mit der entsprechenden Kostenverordnung (Amtsblatt 14/93) kostenpflichtig.

Anmerkung: Um die Einhaltung des EMVG sicherzustellen sind die Geräte, wie in den Handbüchern angegeben, zu installieren und zu betreiben.

Japan VCCI Class A compliance statement

この装置は, クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI－A

Eurasian compliance mark

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